Heating Piping & Air Conditioning

with which is merged the Aerologist

Design, Installation, Operation, and Maintenance: Industrial, Commercial, Institutional, and Public Buildings

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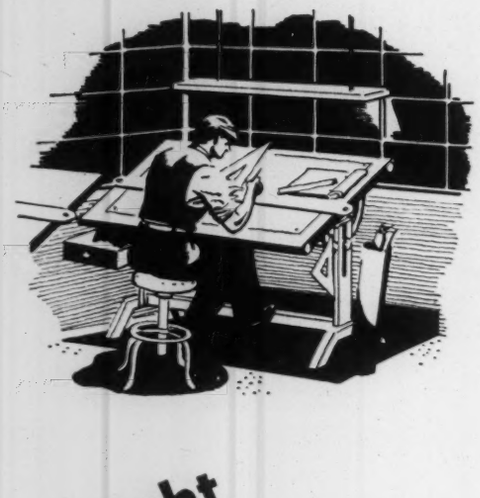

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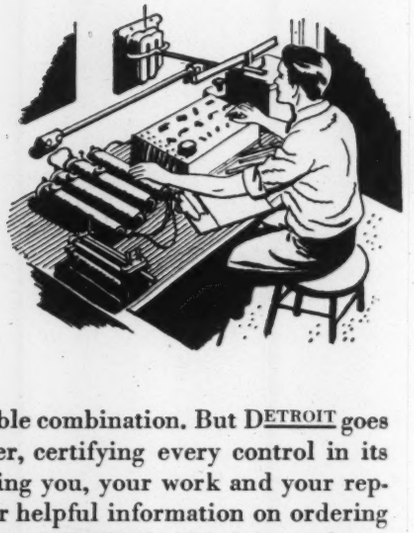

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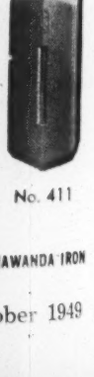

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THE EDITOR'S PAGES

GENERAL CONTRACTORS FIND BUSINESS "STABILIZED"

Business conditions nationally have stabilized for the general contracting industry in the construction of buildings, highways, airports, railroads, and engineering projects.

Construction costs are stabilized or declining slightly on a national scale. They are at an estimated 10 percent below the recent peak.

Contractors generally report adequate supplies of materials, machinery, and manpower—with a noted increase in productivity and efficiency.

Competition has become keen for the new work coming on the market.

All of these factors mean that the public now can get full value for its investment in construction.

These are the salient features of replies to a nationwide survey conducted by the Associated General Contractors of America for study at the midyear meeting of its governing and advisory boards held last month.

The survey was conducted among the AGC's 107 affiliated local organizations, and among its directors, throughout the United States and Alaska, representing more than 5300 member firms which annually perform an estimated 80 percent of all types of the nation's contract construction.

In most areas, industrial and commercial building were reported below last year's volume, and in many cases residential construction was lagging.

The slack was being taken up, however, by a heavy volume of public and institutional building, which showed indications of continuing to increase. It appeared that those in charge of the public purse were taking advantage of lower costs to launch substantial programs in state, county, and municipal building; in the construction of schools and hospitals. Church and other private institutional building also were on the upgrade.

Half the builders reported more building work coming on the market; 30 percent, less work; 20 percent, unchanged.

ANNOUNCES UNDERGRADUATE WELDING AWARDS

The third annual competition of the engineering undergraduate award and scholarship program was announced last month by the James F. Lincoln Arc Welding Foundation, Cleveland 1. The program offers annually $6750 in awards and scholarship funds to engineering undergradute students and to schools for the best papers prepared by undergraduates on arc welded design, research, fabrication or maintenance. A total of 77 awards ranging from $1000 to $25 will be awarded students and $1750 for seven scholarships will be awarded schools.

DOUBLE GLAZING CUTS AIR CONDITIONING LOAD

A 3 ton saving in capacity of the air conditioning equipment was effected for the Chicago office of A. Epstein & Sons, engineers, when they specified insulating glass for their new building. High occupancy and artificial illumination reduced the saving considerably, but such glass, especially when one light is heat absorbing plate, lowers both the original and operating costs of air conditioning plants. Recent laboratory tests have shown this type of double glazing to be effective in reducing solar heat transmission from direct and diffuse radiation and from conduction and convection.

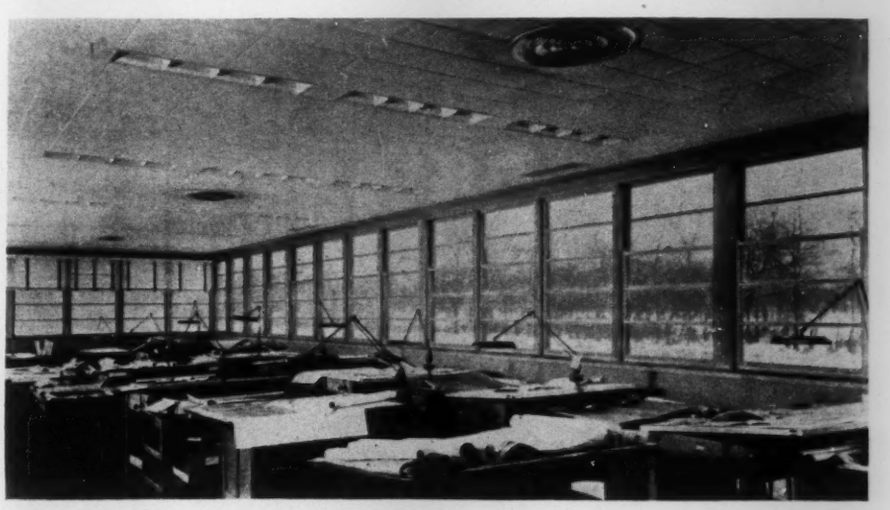
INDIVIDUAL ROOM CONTROL FOR UN BUILDING

Nearly every worker in the new United Nations Secretariat building, to be completed in New York next year, will be able to select his own weather conditions. In what is believed will be "the largest job of individual room temperature control ever installed in an office structure," 4000 high velocity unit air conditioners in the peripheral area will be used in combination with conventional central conditioning systems for the center areas of the rectangular shaped, 39 story building.

J. A. Cutler, president of Johnson Service Co., points out that the prospect of people from 58 nations, representing every known climate extreme and all those in between and working together in one building, multiplies many times the familiar problem of maintaining office conditions to everyone's thermal satisfaction. Fortunately, office temperature will never be a barrier to United Nations harmony, for each office will have its own individual room temperature control.

According to Mr. Cutler, the design provides that primary air will

A saving of 3 tons in air conditioning capacity resulted from the use of insulating glass at A. Epstein & Sons (photo courtesy Libbey-Owens-Ford Glass Co.)



THE EDITOR'S PAGES

be supplied by a high pressure conduit system and introduced into the unit, where it will mix with recirculated air drawn from the room and through the unit's coil. A heating-cooling thermostat, mounted in the unit, will control a valve on the water supply to the coil in the unit. The operation of the valve will determine the amount of heat added or extracted from the recirculated air, cold water being supplied to the unit in warm weather and hot water in cold weather. The heating-cooling thermostat can be adjusted easily to the desired temperature through a small door in the top of the unit. The bulb of the thermostat will be behind the return air grille, where it can accurately sample room air.

The areas in the center of the building will be conditioned by conventional, low velocity central systems with a separate duct to each area. Individual room control will also be provided in these areas.

The narrow end areas of the building will, in general, be heated by radiant panels, with weather-compensated controls used to prevent thermal lag in the panels when the weather changes.

It is expected that some 4,000 people eventually will occupy the Secretariat building. The Secretariat is the administrative agency of the United Nations and is responsible for carrying out the programs and policies of the other United Nation branches. The Secretariat building is the first and largest of four which will ultimately comprise United Nations headquarters.

FROSTED SIGN SPELLS GREETING

It's a bit early to print "Merry Christmas" news, but the Noland Co., Inc., Norfolk, Va., wholesaler of heating and industrial supplies, came up with a very ingenious stunt last year.

On December 15, they installed a sign over the city sales counter, consisting of soft copper tubing mounted on plywood, painted dark green. A 1/6 hp condensing unit was hooked up, and the result was a beautiful, frosted "Merry Christmas" to everyone.

The sign, in continuous operation until December 30, required defrosting only twice in the two weeks.

SPECIAL OIL COOLS CYCLOTRON

Circulated at a rate of about 600 gpm, a specially developed oil will be used to cool the two giant 90 ton magnet coils of Carnegie Tech's 400 million electron volt syncro-cyclotron.

This "cyclotron oil", as it is named, permits direct contact cooling of the cyclotron's copper magnet coils, and hence enables them to be wound more closely than others.

Developed exclusively for this use and donated to the cyclotron project by Gulf Oil Corp., the cyclotron oil will carry off heat from cooling channels as narrow as 1/16 in. between the coil windings. The oil has the unusual characteristic of resisting break down or sludging under the destructive catalytic action of copper, and is a good electrical insulator.

An elaborate circulating system will pump the oil upward through some 24,000 channels in the magnet coils, and thence to a heat exchanger. Here it will be cooled by water from a 42 ft external cooling tower, and returned to the machine.

In this cycle, about 1,300,000 Btu per hr dissipated by the magnet coils will be continuously carried off.

Nine hundred gallons of cyclotron oil is needed to fill the system to capacity.

Soft copper tubing hooked up to a condensing unit spelled a message in frosted letters

"QUOTE"

"Employers throughout the nation are becoming increasingly aware of the fact that, in the case of physically handicapped and older employees, their seeming disability is frequently more than offset by consistent good job performance, steadiness and reliability, as well as lower personnel turnover and a lower incidence of absenteeism.

"This is graphically revealed in reports from about 300 employers who were jointly surveyed by the Chamber of Commerce of the United States and the National Association of Manufacturers. The companies canvassed represent a wide variety of small, medium, and large size concerns in many fields of industrial activity and business endeavor located in most of the 48 states of the Union.

"The usual test applied by most of these companies in selecting employees to fill occurring vacancies is not based on age or physical factors, but rather on the ability of the applicant to do the job under consideration, the survey indicates. Business and industry on the whole are shown to be alert to the productive effort contributed by older workers, so that age is not considered a primary factor in job qualification.

"Most of the employers approached express general satisfaction with respect to job performance of both physically handicapped and older workers. Many companies comment favorably with reference to the stability, reliability, experience, conscientious job application, and similar characteristics which typify these workers."—Chamber of Commerce of the United States.

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"OPEN for DISCUSSION"

DO YOU HAVE something to say about any of the articles published this month? An additional comment, or perhaps a question on some point? We follow here the custom of engineering society meetings in allowing a period for discussion following presentation of a paper. You are invited to contribute your views. Address them to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2

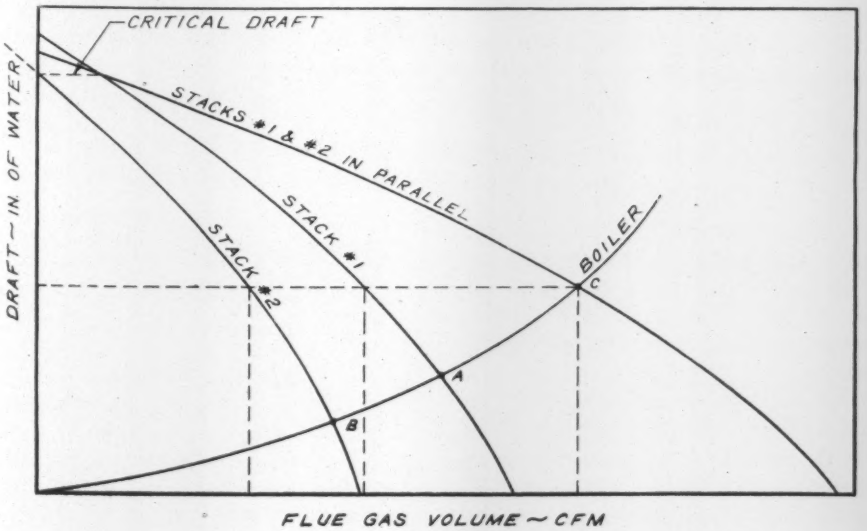
ONE OR TWO INADEQUATE STACKS BETTER?

Referring to the article on page 98 of the September HPAC, One Inadequate Stack Will Do a Better Job Than Two, I am convinced that two stacks will *always* do a better job than one if they are anywhere near the same in height and temperature.

The accompanying chart shows typical performance curves for two stacks of unequal draft with a typical "performance" curve for a boiler showing draft required to produce different volume rates of flue gas (that is, draft required for different rates of combustion). The operating point occurs, of course, at the intersection of the stack performance curve and the boiler curve.

Points *A* and *B* are the operating points for the system when employing Stack No. 1 or Stack No. 2, respectively, but not together.

Typical performance curves for two stacks of unequal draft, with typical "performance" curve for a boiler showing draft required to produce different volume rates of flue gas. Stack temperature is 600 F



When the two stacks are operating in parallel they will be operating at equal draft—the draft at the boiler flue. Each stack will be exhausting the volume shown on its performance curve for this draft point, since the performance curve is fixed for each stack with a given condition of atmosphere and flue gas.

A combined performance curve can thus be drawn as shown for the two stacks operating in parallel by adding their volumes at each draft point on the chart. For drafts greater than the zero volume draft of the lower curve, Stack No. 2 will experience reversed flow; therefore, the lower curve must be extended into the region of negative volume in order to complete the combined curve.

The operating point of the combined system will be at the intersection of the boiler and stack curves, Point *C*, which is higher up on the boiler performance curve than either *A* or *B*. The horizontal dotted line indicates the operating draft of the combined system and the vertical dotted lines indicate the volume handled by each stack and the total volume.

It is seen at a glance that Stack No. 2 is helpful *at all drafts lower than its zero volume draft,* but is a hindrance at higher drafts since the air flow in it reverses and becomes a part of the total volume being exhausted by Stack No. 1.

Obviously, the poor boiler performance referred to in the September article when using two 12 in. stacks in place of the single 20 in. stack recommended is due to the lower available draft of the smaller diameter stack resulting from the greater friction loss at equal velocity. According to the laws of fluid friction, friction loss is inversely proportional to the diameter. Two 12 in. stacks, then, when exhausting at the same velocity as one 20 in. stack would have 1.67 times as great draft loss and would exhaust only 0.72 times as much gas. However, the two 12 in. stacks would *not* operate at the same velocity as the 20 in. stack due to the lower available draft and resultant lower boiler output; the reduced boiler output would reduce the stack temperature which would still further reduce the available draft and cause yet further reduction in boiler output. The net result would be a greatly reduced boiler output.

May I say in conclusion that with one stack warm and the other cold the results would indeed be worse than using the warm stack alone, since the draft of a cold stack is zero. The cold stack would act somewhat like a hole in the breeching, bleeding in outside air and thus reducing the draft available at the boiler flue.—R. A. GERLITZ, chief engineer, Propellair Div. of Robbins & Myers, Inc., Springfield, Ohio.

COORDINATING DESIGN AND OPERATION

I believe William B. Pride's discussion on designing systems for good operation and maintenance (published on these pages in the September HPAC) is an excellent one. He brings out a number of points which are all too often overlooked. If individuals who will be in charge of operation and maintenance of the mechanical equipment in a project could sit down with the architect and consulting engineer to discuss the problems, much, I believe, could be gained.

The responsibility of the equipment manufacturers and their representatives is quite clear as re-

"OPEN for DISCUSSION"

gards the information which they can make available to the architect and consulting engineer, and also to the operating engineer and maintenance departments—providing of course, they are given such an opportunity. The sales engineer or representative who does not welcome an opportunity to follow his jobs certainly "misses the boat."—A. O. MAY, secretary, Stannard Power Equipment Co., Chicago.

METHOD OF UTILIZING ELECTRIC STORAGE HEATING

I have read with a great interest the article by W. Bruce Morrison in the June HPAC, describing an electric storage heating installation in a school building, and the discussion by John Howatt in the July HPAC.

A few similar installations have been made in France with different principles for the storage.

The storage tank is vertical and the heating electric resistance or steam coils are fitted in a water heater. The circulation between heater and tank is by a pump.

A thermostat acts progressively on a valve to increase the supply of water, if the temperature increases, decreasing if it becomes lower than desired, in such a way that the temperature is constant. This temperature is the highest possible compatible with the height of the expansion tank, practically 10 deg lower than the boiling point under the corresponding pressure. In this way, we get the maximum heat accumulation for the tank capacity.

Hot water enters the upper part of the tank, water from the accumulator going out the cool lower part. A separation zone—of which the height is not higher than 10 in.—comes down and up, according to whether the accumulator is in a period of heating or of cooling.

Cooled water from the heating system is brought to the bottom. A perforated partition obliges the water—of different temperature according to the load—to distribute evenly in the whole section of the tank.

The first installation of heat accumulation based on this principle was installed according to my plans in 1930 to heat water for dyeing using steam. It is now used for heat production in high pressure hot water heating, when the heat expense is very variable.—A. BEAURRIENNE, engineer, Paris, France.

* * * * *

I was very much interested in seeing the above remarks from Mr. Beaurrienne and feel that the system which he has used has some advantages over the system which we have used on the Cascade Locks school, as described in my article in the June HPAC. By using a variable flow and constant high temperature on the supply to the tank, he is able to furnish a constant high temperature water to his heat requirement regardless of whether the tank is 10 percent full or 100 percent full of heated water. I was particularly interested in his statements inasmuch as I may at some time have need for just such a system.

On the Cascade Locks situation, we were fortunate in that the temperature of the storage water was not too critical and we used an outside mixing or proportioning valve to furnish us with the required temperature water. We also noticed that the separation zone between the hot water and the cold water was not more than 10 in. as mentioned by Mr. Beaurrienne.—W. BRUCE MORRISON, consulting engineer, Portland, Ore.

BASIC PRINCIPLES OF PIPING

A. D. G. Isherwood, in his further comments on my article on steam piping in the September "Open for Discussion" columns, seems to me to be confused in regard to the basic principles of steam piping design.

In the second paragraph of his comments, he says that "if the valve is shut and the header is common to several boilers, condensate will flow from the header down into the valve and tend to fill up the boiler branch pipe to the bottom of the header."

Drains, properly trapped, should be provided for all stop valves. Therefore, if this valve were closed no condensate could collect above the valve in the event that it was closed.

In the next paragraph, he states that his proposed arrangement would be "superior from an expansion point of view," and that he would be interested to hear what I have to say on this. I do not understand this statement.

His statements on what is actually happening in a saturated steam line while in operation do not seem clear to me. Perhaps the following will help:

In a saturated steam pipe, even when well insulated, the interior walls of the pipe will be covered with moisture. The heat loss through the pipe insulation will result in condensation of part of the steam. No part of the steam pipe will have a dry surface. If the line velocity is low enough so that the steam flow is laminar, no disturbance from the steam flow will prevent the condensate from flowing to the bottom of the pipe and from there to the low point in the line, regardless if the line is sloped in the opposite direction of the steam flow or in the same direction as the steam flow.

If, however, the line velocity is high enough to create a turbulent flow, the steam will wipe the condensate from the pipe walls and carry it to the prime mover as "wet saturated steam." This is admitted to be an undesirable condition. Therefore, why not design the piping system to avoid this condition by specifying pipe lines of sufficient size to allow the steam to flow in laminar or at least in transition flow?—HERMAN VETTER, consulting engineer, Los Angeles.

BLOWER SAVES HAY FROM FLAMES

According to a recent news dispatch, a Vermont farmer used a powerful blower to store 75 tons of chopped hay in his barn earlier this year. When the barn caught fire a couple of months later, he reversed the blower to pump the hay out and save it from the flames.

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The Physical Side of

COMFORT

IN THE CURRENT literature of the air conditioning profession, there are many articles and papers discussing the physiological factors affecting comfort. Because their content is basically medical, they are not always easily read by engineers. The following discussion is therefore intended to give a general background of the physical side of comfort so that more complex discussions of this subject may be read with greater understanding.

Heat production in the body, heat flow to the body surface, and heat loss from the body to its surroundings as influenced by sex, age, acclimatization, shock, radiation effects, and humidity are reviewed. The problem of comfort as an objective sensation is not treated here, but rather an analysis of the physiological factors which influence comfort is presented. This analysis is meant to give a proper background for the evaluation and intelligent use of the comfort standards published by the American Society of Heating and Ventilating Engineers and other groups. The material is a correlation of published literature.

Heat Production in the Body

A heat regulating mechanism exists in man which maintains the body temperature at 98.6 F, which temperature holds with striking uniformity for all normal humans. There may occur small departures of approximately ½ F from the statistical mean; however, any major change of temperature from this control point interferes with the vital processes of the body and death may occur.

In order to provide the body with the heat necessary to maintain the temperature at this optimum level and to keep the body in a state of preparedness for work, a constant energy transformation must occur. These chemical changes taking place within the cells of the body are called *metabolism*. They are the exothermic [heat evolving] chemical oxidations of carbohydrates, fats, and protein.

The thermal efficiency of the body is placed at 20 percent, so that the heat production required for external or internal work by the body is quite large. If the body is to move a force of 1 lb through a distance of 1 ft, 5 × 778 or 3890 Btu of heat must be liberated within the body cells. The great bulk of this body heat is liberated in the muscles, since they account for 75 percent of the total energy liberated by the chemical processes of metabolism. Some energy conversion by the body is accomplished in the glandular organs associated with the functional activities of the body, while the heat production of the skin, bones, joints, and tendons is very low.

In particular, the chemical processes taking place in the physiologically resting body constitute its *basal* metabolism. In the basal condition, all the energy developed by the body is used to supply its own inherent demands—of which temperature maintenance is a vital one.

Factors That Affect Metabolism

Metabolism varies according to many factors—such as age, sex, physical activity, health, climate, and nutrition. Standards of metabolism can be established for defined conditions of the previous factors, but these standards will not hold for all individuals, as human variability always exists.

A discussion of each of the above factors follows.

1) *Men and Women*—It has been known that women have a lower basal metabolism than men. The estimates as to the average difference have ranged from 6 to 15 percent. As a close approximation, the basal metabolic rate for men is 14 Btu per hr per sq ft of body surface, and for women about 8 to 10 percent less. [The Mechanism of Heat Loss and Temperature Regulation, by Eugene F. DuBois; Lane Medical Lectures, Stanford University Press, Vol. III, No. 4.]

A. C. MENKE and C. L. RINGQUIST, air conditioning engineer and manager, respectively, air conditioning department, The Trane Co., La Crosse, Wis., present a simplified discussion of the various factors affecting physical comfort. This discourse was prepared to clarify and explain the background and, hence, the results given in comfort standards widely used in the engineering field

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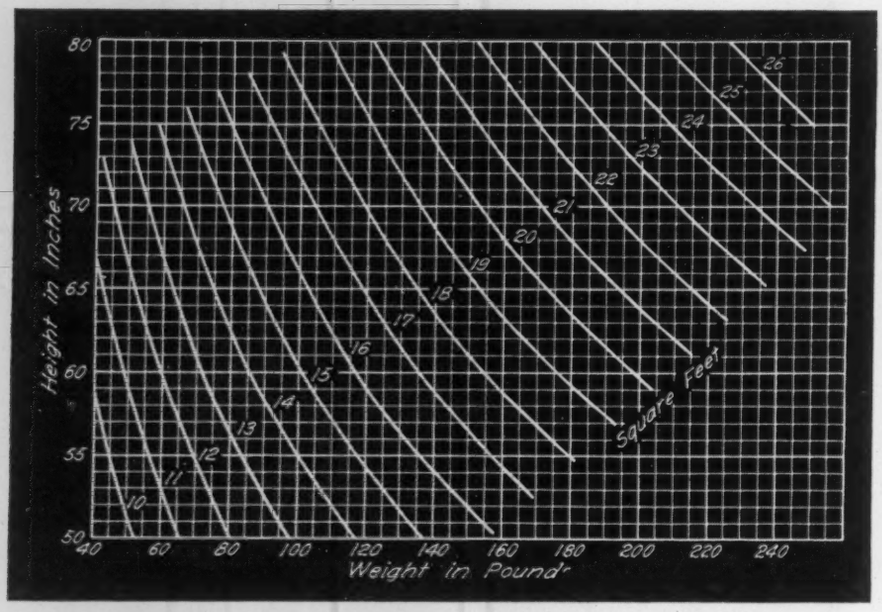

Chart for determining human surface area, when height and weight are given (from ASHVE Transactions, Vol. 35, 1929, p.251)

2) *Age*—As general trends, the level of basal metabolism undergoes a progressive decrease with age except for a slight tendency for the metabolic rate to rise with age from 200 to 600 days. There is a consistent decrease of metabolic rate from ages two to 12, and the beginning of puberty marks a rapid decrease of basal metabolic rate to the adult level. The metabolic rate of the male adult then shows an almost constant rate of decrease from age 20 to the end of life. The female adult maintains a practically constant metabolism from age 20 to the time of menopause, following which metabolism decreases for the remainder of life. [Changes with Age in the Basal Metabolic Rate in Adult Men, by W. H. Lewis; American Journal of Physiology, Vol. 121, 1938, p. 502.]

3) *Acclimatization*—In addition to age and sex, basal metabolism may vary due to differences in climate. There is apparently a chemical regulation of body heat production as a factor concerned in acclimatization. Mills [Physiologic Response of Man to Environmental Temperature, by F. K. Hick, R. W. Keeton, and Nathaniel Glickman; ASHVE Transactions, Vol. 44, 1938. Discussion by C. A. Mills] reports a definite drop in heat production as body heat loss becomes difficult due to atmospheric conditions. In general, the basal metabolic rates are higher in cooler climates and at higher altitudes. This is reflected in an individual's desire for higher environmental temperatures for comfort in summer than in winter.

4) *Race*—While the basal metabolism may also be modified by racial differences, more recent evidence points out that deviation from the Caucasian standards ascribed primarily to racial differences are often more dependent upon climate and nutrition. This is according to Goeure and Rodsman [Energy Metabolism, by J. R. Murlin; Annual Review of Physiology, Vol. I, 1939, p. 131], who wrote that social status and, therefore, differences of nutrition account for metabolism variations often attributed to racial variability.

5) *Body Surface Area*—Since quantity of heat flow depends upon surface area, it is assumed that under physiological conditions basal metabolism is proportional to the extent of the body surface area. This proportionality, called the Surface Area Law*, was formulated by Rubner in 1883 [Max Rubner; Archiv für Hygiene, Vol. 27, 1896, p. 69]. A chart for determining human surface area when given height and weight as compiled by DuBois is reproduced herewith. In general, tall persons have a greater surface area and, therefore, a greater metabolism than short persons of the same weight.

6) *Physical Activity*—The increase of heat production above basal due to body activity has been investigated by many groups under a variety of conditions. Metabolic rates of men at different activities are given in an accompanying table. These values are reprinted from the ASHVE's Heating, Ventilating, Air Conditioning Guide and are the standards most widely used in computing cooling loads due to human occupancy.

It should be remembered that all heat produced within the body must be dissipated to the surroundings if the body temperature is to remain constant. In the light of the preceding discussion, the values given for men at rest in the accompanying table should be decreased approximately 10 percent where the comfort air conditioning is for older people, or for women. These groups will desire slightly higher temperatures for comfort than will the adult male. Children at rest have a metabolic rate higher than the values given in Table 1 by approximately 10 percent. Because of greater heat production, and thus the necessity of increased heat dissipation, children will desire lower temperatures for comfort than will adults.

7) *Body Regulation of Heat Production*—Despite these fluctuations of metabolism, the body temperature does not vary significantly. The total heat loss from the body to the surrounding environment normally balances the heat production by metabolism so that body temperature is practically constant at 98.6 F. Under usual conditions, the heat transfer from the body is accomplished by radiation, convection, and evaporation. At times, when control of body temperature by these avenues of heat loss is not adequate, body temperature may be regulated slightly by control of heat production. Partially, we do this voluntarily—for on hot and humid days we refrain from exercise while on cold days we increase heat production by muscular exertion. This regulation of production of heat to control body temperature can also be unconscious and involuntary. When the body becomes cold, spontaneous muscular contractions occur in the form of shivering and teeth chattering and the heat production may increase several times the basal value. The start of shivering is not indicated at any criti-

*This law is not universally accepted, for many physiologists believe that basal metabolism is more correctly associated with body weight rather than surface area.

cal temperature for the onset may be a reflex to perception of cold or may result from physiological controls due to lowered body temperature. It is impossible to differentiate between the muscular actions caused by the two stimuli.

There is another kind of regulation of heat production associated with the muscles. In cool environments there is a slight unconscious tensing of the muscles without sign of tremor or shivering and in warm environments the muscles are partially relaxed and produce little heat. These small changes of muscle tenseness are rarely noticed by the subject himself. Physiologists call such control "muscle tone."

In addition to muscular control of heat production, there is apparently a more fundamental control of the metabolic processes of the body. Hardy, Milhorat, and DuBois [Basal Metabolism and Heat Loss of Young Women at Temperatures from 22 C to 35 C, by J. D. Hardy, A. T. Milhorat, and E. F. DuBois; Journal of Nutrition, Vol. 21, April 1941, p. 383] have given evidence of women's ability to control the basal metabolic processes to facilitate the maintenance of thermal equilibrium in an environment. This chemical regulation of heat production does not seem to exist in males.

Measurement of the basal rate of nude women [Hardy et al] for temperatures between 70 and 80 F ranged from 11.5 to 14 Btu per hr per sq ft of surface area. In the cool zone, below 70 F, the average rate was 14 Btu per hr per sq ft and in the warm zone, above 80 F, the average rate was 11.5 Btu per hr per sq ft. The basal rate of nude men was practically constant at 14 Btu per hr per sq ft throughout the temperature range 70 to 95 F. In comfortable environments, the metabolism of women is 8 to 10 percent lower than that of men of the same size; but in a cold environment, it may be the same as that of men and in a very warm environment may be 15 to 20 percent lower.

Metabolic rates of men at different activities

Activity	Ave. Total Metabolic Rate Btu per Hr
Sleeping	255
Awake, quiet	300
Seated, at rest	380
Standing, at ease	430
Walking, 2 mph	760
Walking, 4 mph	1400
Maximum exertion	3000-4800

From ASHVE's Heating, Ventilating, Air Conditioning Guide, 1948, p. 209.

[This is the first of several articles on the physical side of comfort, by Messrs. Menke and Ringquist.]

CONSERVATION OF FUEL RESOURCES

The fuel reserves of the nation are being consumed at an alarming rate. If present trends continue, the indications are that the reserves of natural gas and petroleum in the United States will become exhausted before the end of the century. Only coal appears to be in appreciable supply, with estimated reserves sufficient for approximately 2000 years at existing rates of consumption.

On an equivalent heat basis more oil and gas are used per year than coal. Consequently, a depletion of our fluid fuel reserves would materially affect the economy of the nation. Serious consideration would have to be given to the domestic heating situation alone, a field where increased use is being made of oil and gas. Of even greater magnitude would be the problems confronting the transportation industry, the largest consumer of petroleum products.

Much effort is being expended toward the conservation and intelligent utilization of our fuel resources. Engineers are constantly striving to improve the efficiency of power equipment so as to obtain the desired result with less expenditure of energy in the form of combustion of fuel. In order to further mitigate the situation, the conversion of coal to liquid fuel can be resorted to, but the present status of this process is of relatively low efficiency as the energy in the required coal is more than twice that of the liquid fuel produced. Furthermore, the successful operation of the process would depend on a continuous supply of coal, a not too reasonable expectation in view of the labor situation in the mines.

The gas turbine appears to possess many attractive potentialities for relieving the serious situation of diminishing fuel reserves. In conventional mining practices much coal is left underground after operations cease, because beyond a certain point a marginal return would be realized. Experiments under sponsorship of the Bureau of Mines are now in progress, however, where the coal remaining in such an abandoned mine is burned underground. The air required for this combustion can be supplied by a gas turbine, and the gases leaving the mine can, in turn, be burned in the turbine to supply useful power. Thus, in this instance of underground gasification, the gas turbine affords a means of reclaiming otherwise discarded fuel and thereby prolonging our reserves.

The science of nuclear fission is ever advancing and it is reasonable to expect that within the next decade power may be produced by such methods. In this process, instead of burning a conventional fuel, heat would be obtained from a radioactive reactor. The heat thus produced could be imparted through a heat exchanger to a gas turbine cycle from which power is obtainable. The gas turbine has the unique advantage of being the most direct and simplest means of utilizing such energy. The "fuel" supplied to the reactor could be uranium or thorium, thus extending the reserves of conventional fuels. Production of power by this means would be another step, wherein a gas turbine is employed, toward fuel conservation, but it should not be assumed that the supply of uranium and thorium is inexhaustible, as such is not the case.

Since our solid fuel reserves are in much greater abundance than those of oil or gas, wise utilization would be in the direction of developing efficient equipment capable of using the former in preference to fluid fuels. Most central power stations use coal, as do most steam locomotives. The very low thermal efficiency of the latter, however, has encouraged the entry in the railroad field of the diesel locomotive with its much higher efficiency. As a result, practically all locomotives now on order are of the diesel type. The diesel locomotive has given an excellent account of itself in railroad service, but increasing its numbers aggravates the diminishing oil reserve situation and does not contribute to the alleviation of the imbalance between solid

[*Concluded on page 82*]

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Drips and Drains Important Parts of Process and Power Piping Jobs

FAILURE TO provide adequate drips and drains for a piping system should be termed a serious oversight, for the omission will inevitably exact its toll in added costs.

In the design and installation of power and process piping, the drips and drains all too frequently are treated as an after-thought, get casual attention, or are relegated to a very minor position in planning. Consequently, they often are inadequate, make-shift in character, or at best are only partially effective. The American Standards Association Code for Pressure Piping recognizes the importance of drips and drains; the section covering power piping reads significantly in part as follows:

"Suitable drains or drips shall be provided wherever necessary to drain the condensate from all sections of the piping and equipment where it may collect. Suitable drains shall also be provided for emptying water lines, water storage tanks, equipment containing water, etc., at times when such piping and equipment may be out of service.

G. W. HAUCK, manager of engineering sales, Crane Co., Chicago, gives good, practical tips here on drips and drains for piping systems, illustrating his points with actual examples. In conclusion, he quotes the statement that "consideration by the designer of the entire plant piping layout from a 'drainage' viewpoint will often result in simplification and better design of the piping system."

At least one valve shall be placed in each drip or drain line."

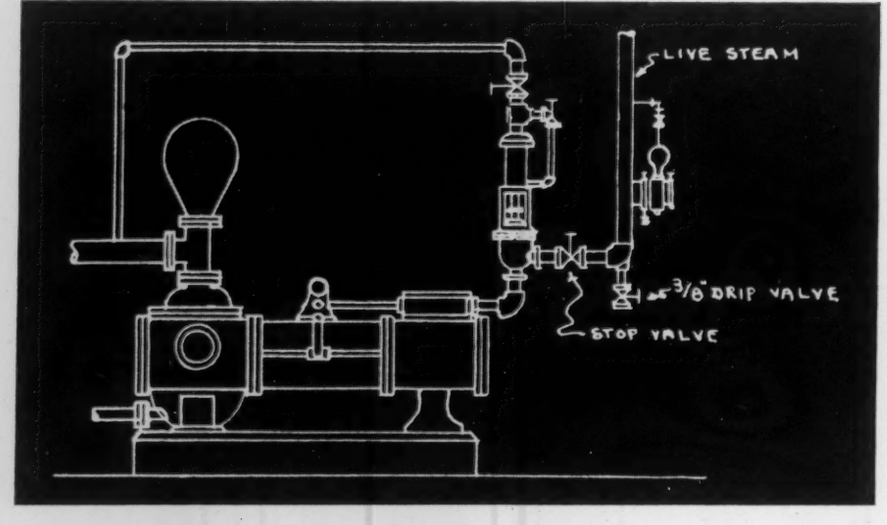
Drips and drains, although relatively small in pipe sizes and relatively minor in total tonnage compared with the major piping, should be regarded as an important and integral part of the piping system and treated as such.

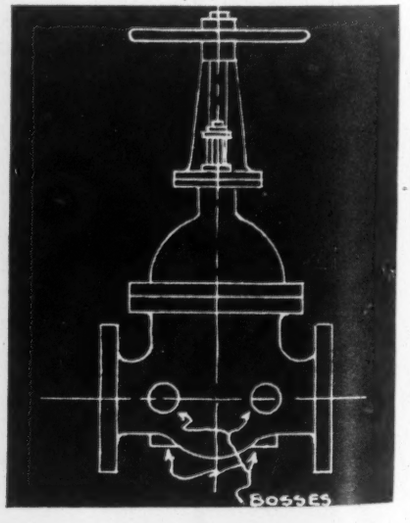
Our purpose here is to discuss some common faults and omissions; and, further, to show how easily efficient and practical drips and drains can be provided.

Draining Steam Lines to Auxiliaries

The steam supply lines used for conducting saturated steam to pumps or other auxiliaries, to cookers, vessels, and the like are legion in power plant and process piping. Fig. 1 illustrates a simple but effective method of draining the steam supply line to such equipment. For smaller supply lines, in the order of 1½ or 2 in. size and smaller, a small hand-operated drip as shown will suffice. It is especially useful for removing condensate which has accumulated during a shutdown. Draining this condensate before operating the control valve in starting up the unit will reduce wear on the seating surfaces of the control valve and will also eliminate the possibility of damaging equipment through a slug of water.

Left—**Fig. 1—Simple method of draining steam supply line to pumps or other auxiliaries.** *Right*—**Fig. 2—Bosses permit gate valves to be tapped for draining when valve is in vertical or horizontal position**





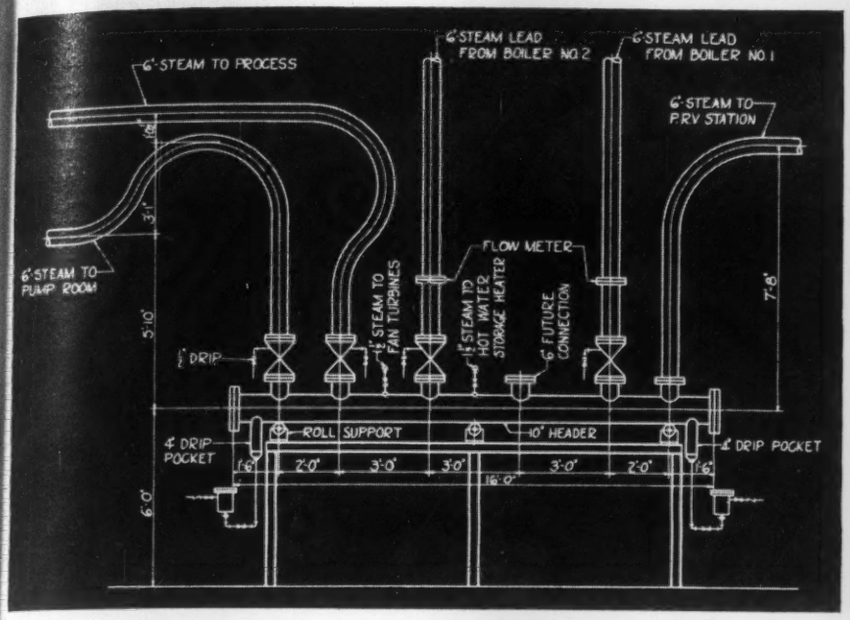


Fig. 3—Method of insuring removal of condensate from steam headers

When the stop valve is located in a vertical steam supply line, the small connection for a drip valve can be welded in the piping immediately above the stop valve.

For larger units or auxiliaries, it is advisable to install separators, properly trapped, in saturated steam lines, and, in some cases, in superheated steam lines.

Draining Lines Adjacent to Valves

As standard practice, valve manufacturers provide six bosses on the relatively larger sizes of 250 lb iron body and all steel gate valves. Two of these bosses are located on the bottom and two are on each side of gate valves, as illustrated in Fig. 2. These bosses permit tapping ½ in. pipe threads in 3 in. and 4 in. valves; ¾ in. threads in 5 in. to 8 in. valves; 1 in. threads in 10 in. valves and larger. In lieu of threads, the bosses of steel valves can be bored for socket welding.

This system of locating bosses permits tapping of valves in order that condensate can be drained with the valve in either a horizontal or a vertical position and drained on either side of the disc. When plans are drawn, full advantage should be taken of bosses (if they are provided on valves) and appropriate tappings should be indicated for drains. When bypasses are required on valves, combination bypasses and drains can often be obtained; if not, they can be separate attachments.

If valves are not equipped with bosses, or if they are procured before any provision for tapping can be determined, facilities for drainage can be made by welding a coupling or pad in the adjacent piping and close to the valve.

Draining Valves in Boiler Leads

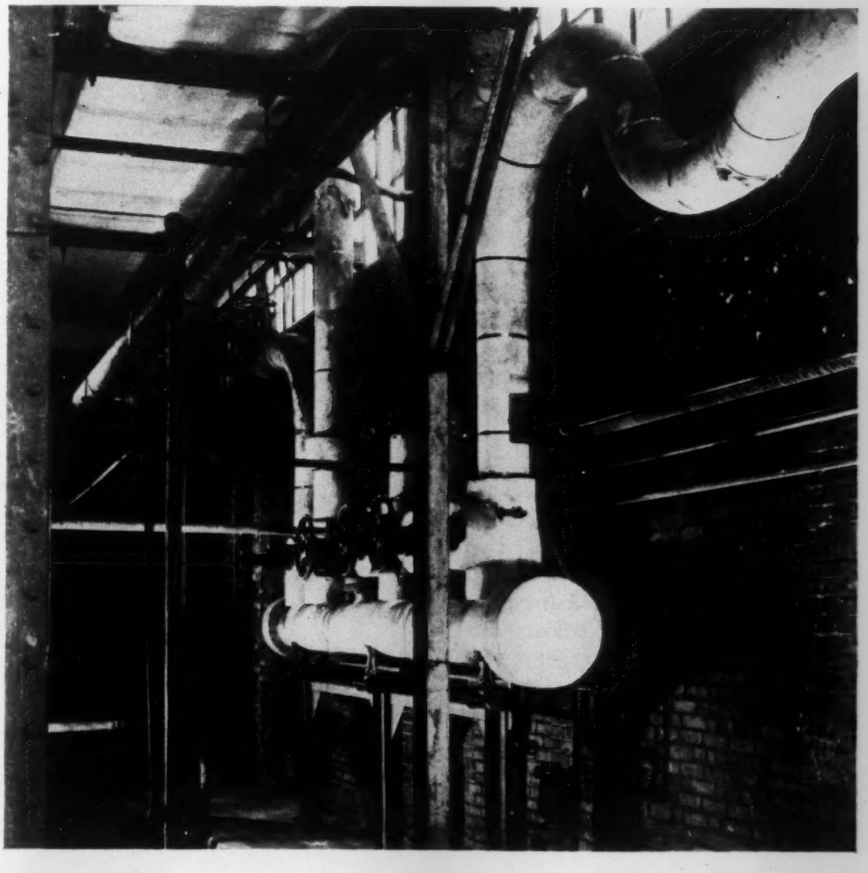
If piping is so arranged that condensate can collect above the disc of automatic stop-check or boiler non-return valves during a shutdown, such valves should be provided with an adequate drain. Otherwise, a dangerous slug of water may be carried at high velocity through the line and prove dangerous.

Similarly, when the gate valves of boiler leads are located at the steam header, it is especially important that drips be installed for draining condensate above the discs before opening such valves and cutting the boiler lead into the header. Fig. 3 amplifies this point.

Draining Steam Headers

It is not uncommon to find steam headers equipped with one or two small tapped openings on fittings or welded bosses in the piping, or perhaps a small eccentric connection at the end of the header. While such tapped openings will permit the removal of some condensate,

Fig. 4—Photo of header arrangement shown in Fig. 3, with the drip pockets and steam traps visible. Note valved drain for nearest gate valve; the other valve drains are hidden from sight



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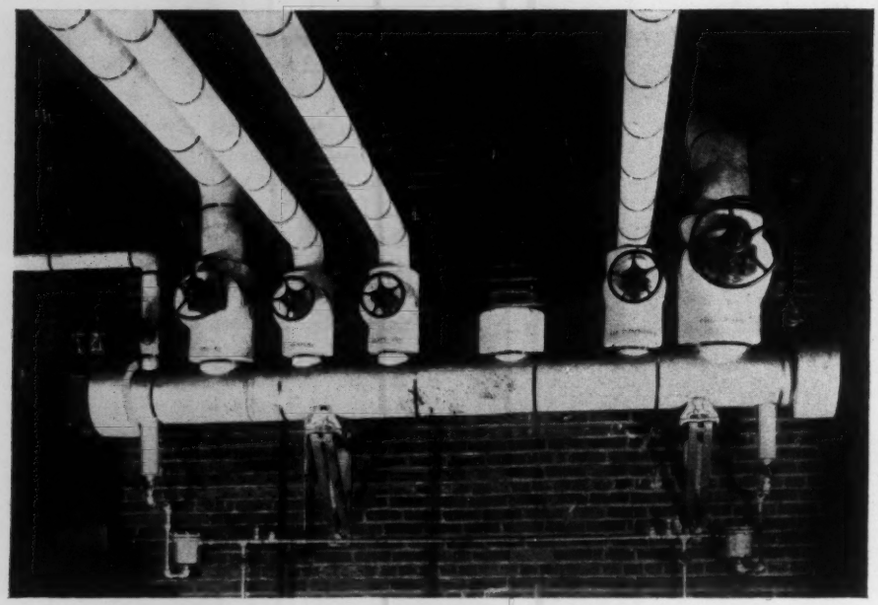


Fig. 5—Distribution steam header in pump and auxiliary room, equipped with individually trapped welded drip pockets

they are relatively small in size and, when higher velocities are employed, condensate is carried past these small openings.

A preferable method of insuring the removal of condensate from steam headers is detailed in Fig. 3. This 10 in. header is equipped with two 4 in. welded drip pockets which insure complete separation of condensate for automatic removal by steam traps, even when higher velocities obtain. These drip pockets also provide a reservoir for slugs of water, should they occur.

This article is not intended to deal with steam traps because it is a separate subject and one which has been discussed several times in this magazine. However, it is not amiss to remark, in passing, that the traps should be of the very best and efficient types to complete the function of draining, because the drip pockets are dependent entirely for their effectiveness upon the ability of the traps to discharge condensate as rapidly as it occurs.

Fig. 4 is a photograph of the header arrangement illustrated in Fig. 3. The welded drip pockets and steam traps are visible. Also note the ½ in. valved drain above the disc of the nearest 6 in. gate valve; the other valve drains are hidden from sight but they are there.

Fig. 5 shows a distribution steam header in the pump and auxiliary room of the same plant referred to in Figs. 3 and 4. This is a 6 in. header, equipped with two 3 in. welded drip pockets which are individually trapped.

Draining Long Lines

Long saturated steam lines should be drained at intervals and at terminal ends, preferably through drip pockets, adequately trapped. The length of the line, its contour, and conditions of flow determine the number and the location of drip pockets.

Fig. 6 shows the terminal end of a long line. This drip pocket has the condensate outlet connection on its side, plus a blowoff connection at the bottom for the periodic removal of accumulated scale and foreign matter, also for complete drainage of the line in the event of a shutdown.

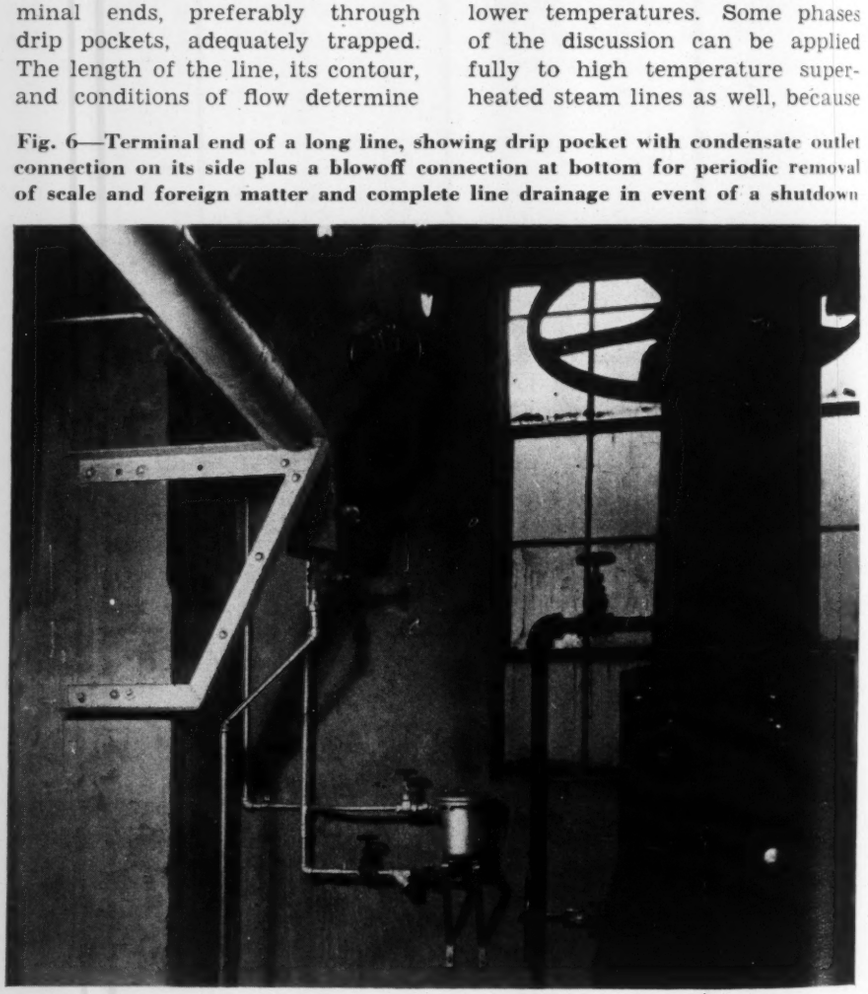
Draining Rises in Steam Lines

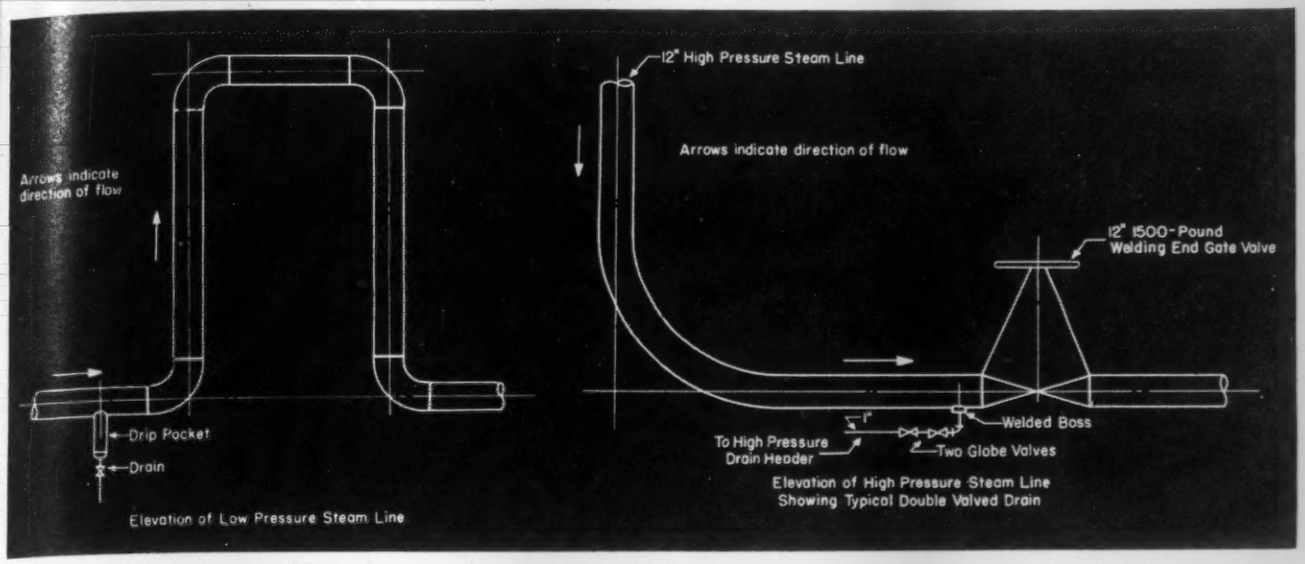
Any type of expansion pipe bend which is installed vertically, or any riser in a steam line, should have provision for drainage ahead of the vertical rise. Small-sized piping may be drained effectively by a tapped boss or other small connection. However, larger sized lines should have the benefit of a drip pocket, as shown in Fig. 7.

Drips for Superheated Steam Lines

Most of the previous discussion applies particularly to saturated steam piping or lines with relatively small amounts of superheat or lower temperatures. Some phases of the discussion can be applied fully to high temperature superheated steam lines as well, because

Fig. 6—Terminal end of a long line, showing drip pocket with condensate outlet connection on its side plus a blowoff connection at bottom for periodic removal of scale and foreign matter and complete line drainage in event of a shutdown




Arrows indicate direction of flow
Drip Pocket
Drain
Elevation of Low Pressure Steam Line
12" High Pressure Steam Line
Arrows indicate direction of flow
12" 1500-Pound Welding End Gate Valve
Welded Boss
To High Pressure Drain Header
Two Globe Valves
Elevation of High Pressure Steam Line Showing Typical Double Valved Drain

Left—**Fig. 7—Expansion bends installed vertically, or any riser in a steam line, should have provision for drainage. The larger sized lines should have the benefit of a drip pocket.** *Right*—**Fig. 8—Drips for steam lines operating at very high pressures and temperatures are usually installed with double valved drains which are used only when starting up**

even superheated steam lines should have provisions for drips.

When high pressure-high temperature lines are fully operating at normal, there can be little or no appreciable condensate, nor any need for drips while in operation. Nevertheless, condensate is present and should be removed after any shutdown and during the warming-up period prior to a resumption of full operation. It is apparent, therefore, that drips also must be a part of superheated steam lines.

Drips for steam lines operating at very high pressures and temperatures are usually installed with double valved drains, which are used only when starting up and otherwise are closed. Fig. 8 shows such a typical drain as installed ahead of gate valves, flow nozzles, or equipment.

Miscellaneous Drains

The limitations of space indicated that the principal discussion should center about drips and drains for steam lines; therefore, piping involving liquids and air can only be mentioned briefly.

Condensate will occur in compressed air lines. The low points of such piping should be drained and in general the practices outlined for steam lines will apply as a broad overall guide.

Provision should be made in liquid lines, tanks, and equipment for draining when not in service. Some means of venting must also be provided at a high point for complete drainage.

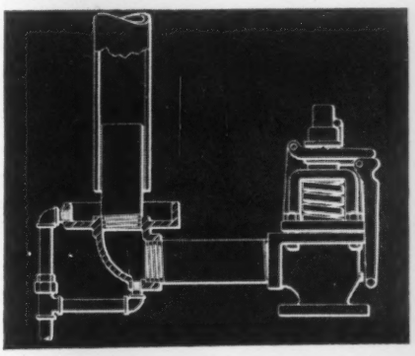
Achieving the goal of adequate drips and drains in all lines and all indicated locations requires careful attention to small details, both in planning during design and in erection of the piping as well. As indicative of this need, Fig. 9 has been included—it is a detail showing how drains should be provided for drip pan elbows in the discharge piping of pop safety valves.

And in Conclusion

A designer, whose opinion is respected, comments that "consideration by the designer of the entire plant piping layout from a 'drainage' viewpoint will often result in simplification and better design of the piping system."

Justification for the stress laid upon proper drips and drains has been proved in actual practice. Adequate drainage proves a safeguard, improves plant operations, and is a profitable investment.

Fig. 9—How drains are provided for drip pan elbows in the discharge piping of pop safety valves



SEES ENORMOUS FUTURE OPPORTUNITIES

In a report which summarizes achievements in each area of our economic life, the Twentieth Century Fund says that by stepping up our output only 8 percent above normal expectations, based on the actual past performance of the American economic system, we could produce enough by 1960 to provide adequate standards of food, housing, education, and medical care for every living American.

"Greatest Assets Ever Possessed"

The report, issued under the title "U.S.A.: Measure of a Nation," scorns any implication that our economic system is "running down" or "mature," but says we face the future with the greatest assets ever possessed by any nation in history, with enormous future opportunities for both public and private investment and business growth.

"By 1960 we shall have opportunity to put $45 billion a year into needed capital goods. On the basis of our best sustained record in the past, during the 1920's, we would be likely to put in about $39 billion. The extra $6 billion is a measured margin of our ability to absorb huge additional investment funds, the frontier on which our system can grow and expand indefinitely," it states.

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View along the south wall footing showing the floor duct takeoffs from the main supply duct and the corrugated iron sheets over this duct which serve as a form for the pouring of the floor slab over. The ducts are wired to the reinforcing rods

Warm Air Ducts in Floors Heat and Ventilate School

ROBERT C. RING, mechanical engineer, Ontario, Calif., describes a school installation completed earlier this year for warm air radiant heating and ventilation. Three-inch diameter galvanized iron ducts embedded in the floor slab and through which warm air is circulated provide radiant heat, and the air is then discharged to the rooms as the tempered ventilation air supply. Variations of the basic scheme are mentioned by the author

WHEN THE school board of the Mira Loma school, Riverside Co., Calif., was considering the means of heating a proposed new eight classroom and kindergarten elementary school, a warm air system with the air passing through the floor to provide a tempered floor and then discharging into the room to provide tempered ventilation air was suggested. In this way, radiant heating could be provided coincident with mechanical ventilation, and at reasonable cost. The school board and the architect, J. Dewey Harnish, were favorably disposed towards this scheme and the plans were prepared accordingly.

The particular buildings in which the first installation has recently been completed are of prefabricated arch rib construction with the arch ribs spaced on 4 ft centers (modules). Long windows extending from 3 ft above the floor level to nearly the plate line are utilized along the north walls with a wide window ledge and shelves between this ledge and the floor. Three-inch diameter galvanized iron duct —a stock material—is embedded approximately in the center of the 6 in. floor slab, three such ducts in each 4 ft space between the arch rib centers.

Since all of these ducts are of equal length, they were all shop fabricated and assembled with soldered joints to prevent entrance of water from the concrete. The ducts presented no special problem to encase entirely within the slab, since they have a definite tendency to float in the concrete. The ducts were wired to the reinforcing rods and the rods in turn were wired together and to the footing rods so that the entire assembly was adequately anchored. No difficulty was encountered in working around the ducts during the actual pour since the spacing allowed reasonable foot clearance, and a 3 in. diameter duct will withstand appreciable load without permanent deformation.

These 3 in. ducts through the floor are supplied from an underfloor concrete supply duct along the south wall footing which supply duct was poured along with the footings and covered with corrugated iron sheets to provide a form over the open top for the pouring of the floor slab. The floor ducts extend through the floor to the north wall where, between the arch

View across the floor from south to north showing the discharge end of the floor ducts at the north wall

ribs, they extend up through the surface of the floor and tie together in groups of three into a header box.

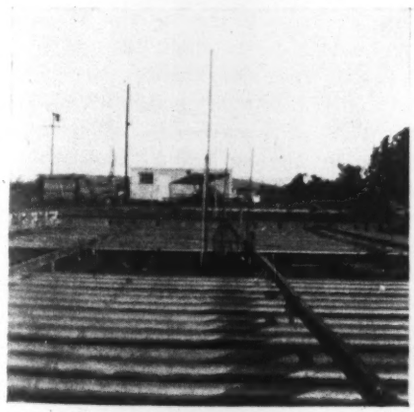
This box connects to a standard, adjustable deflection, 14 in. by 4 in. outlet grille on the window ledge and the air discharges vertically up across the north windows.

Pressure relief is provided by two rectangular openings high in the south wall. This arrangement permits the maintenance of a slight positive pressure in the rooms when the system is operating.

Project Comprises Four Buildings

The entire project consists of two four-classroom buildings, a kindergarten building, and an administration building, the last being heated in conventional fashion with a warm air furnace. Each pair of classrooms is provided with an equipment room located between the two classrooms in which the heaters, blower, filters, controls, etc., are contained. The supply ducts extend out in opposite directions under the floor slab, and the connection to the heating equipment is made through the floor in the equipment room. The kindergarten has its own equipment room at one end of its building.

General view of the floor for each pair of classrooms. The equipment room is over the right half of the open space between the two groups of ducts



Each classroom is 32 ft long and the ducts in the floor slab are provided at seven of the eight 4 ft modules only since the eighth contains a door. The average ceiling height is about 12 ft and the outside width is 30 ft. The kindergarten is the same width and height, but is 13 modules long (52 ft), with ducts in eleven of the modules since one end of the building contains closets and the equipment room under which ducts are omitted. Floors throughout the buildings are finished with asphalt tile.

The mechanical equipment for each pair of classrooms consists of a filter bank; a centrifugal blower of the nonoverloading type; two direct, gas fired, stainless steel heat exchangers; and the necessary interconnecting ductwork and plenums.

The discharge air from the blower is split, half going through one heat exchanger into one classroom and half through the other heat exchanger into the other classroom. In this way, individual thermostatic control is possible for each classroom, a feature specifically requested by the school board in this particular installation. Control is in two steps—a duct thermostat cycling the heat exchanger at approximately 60 percent firing rate to maintain a minimum leaving air temperature, and a room thermostat cycling the heat exchanger at full firing rate. This arrangement provides close room temperature control without adding materially to the cost or complication. The blower, of course, runs continuously when the system is in operation and may be used for ventilating without heating if desired. Air intake is through the equipment room door on the south side of the building. The kindergarten equipment arrangement is similar except that only one heat exchanger is used.

All Outdoor Air Is Used

One hundred percent outdoor air is utilized at all times in this installation, 1200 cfm to each classroom and 1800 cfm to the kindergarten. Under the design inside to outside temperature difference of 45 F, the air temperature leaving the heat exchanger is approximately 115 F with an estimated air temperature at the outlet grilles of 90 to 95 F.

It is estimated that the proportion of heat reaching the room through the floor will be not greater than 50 percent of the total heat supplied, with a probable lessening of this amount as the outside temperature rises. Supply ducts are sized to function essentially under pressure head with conversion to velocity head upon entrance of the air into the floor ducts. This arrangement makes the system practically self-balancing with respect to the individual, equi-length floor ducts and no dampers were provided at any point in the system. Total air flow is adjusted in the usual manner by varying the blower speed. The total static resistance of the system is approximately 1¼ in. of water, of which total the resistance through the 3 in. ducts is the largest single amount. Completion of the installation late last spring prevented obtaining any measured operating and performance data until this season.

View showing the ducts emerging from the floor and connecting together into the header boxes along the north wall. For protection of the surrounding wood, the ducts and the header boxes are covered with asbestos

View of the same wall as in the preceding illustration showing the window ledge and shelves in place and the opening through the ledge for the outlet grille

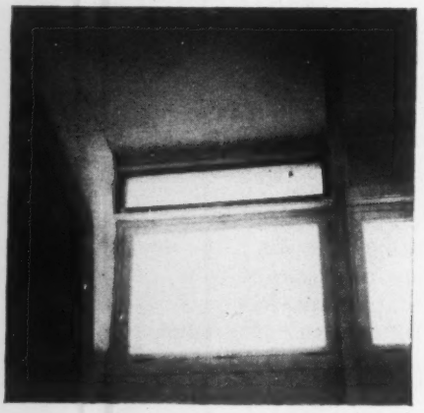
From observation of the operation of this system so far, it is felt that a highly satisfactory thermal environment can be maintained due to the combination of tempered floor and tempered ventilation air. The effect of thermal lag of the floor slab is of relatively small importance since the floor temperature is appreciably less than with a panel supplying all of the heat loss and the volume of air introduced into the room—equivalent to slightly over six air changes per hour—will modify the room air temperature rapidly. And, of course, the value of air discharge up across a cold wall and pressurizing of the room have long been recognized as important contributions to proper thermal environment.

Cost of installation of this type of system is subject to numerous variables depending upon overall project size, type of construction, type of heating medium employed, etc., but in this area the overall cost of this particular installation was approximately the same as that of a first-grade hot water floor panel with individual room control. The 6 in. floor slab represents some increase in cost over the usual 4 in. slab and the underfloor supply ducts are a slight additional cost, but in the conventional hot water floor panel some additional floor slab cost over that of a plain floor is usually encountered.

Obviously, many variations of the basic system are possible such as steam or hot water—coal, oil or gas fired—or electricity as the heating medium; recirculation of ventilation air in fixed or varying amount; various pressure relief arrangements; more or fewer, larger or smaller floor ducts; passing air through the ceiling rather than through the floor; control of areas rather than individual rooms; other methods of temperature control; etc. In this part of the country, where natural gas is cheaply available and winter temperatures are relatively mild, the use of 100 percent outdoor air and direct gas fired heat exchangers offers definite advantages in installation cost and ventilation. In more severe climates, this system has an added advantage in that no supplementary heated air need be introduced into the room to make up the difference between the room heat loss and the heat that can be supplied by the panel without exceeding maximum desirable surface temperatures. Where fuel is more costly and/or where winter temperatures are more severe, the use of recirculation permits fuel saving at no appreciable loss of overall performance.

At this writing, another smaller school installation is nearing completion in which 50 percent outdoor air and 50 percent recirculated air is utilized in fixed proportion. It is, in other respects, the same as the system herein described and the building is of the same general type of construction. Also, a variation of the basic system is being designed for a church where the extreme floor to ceiling height—about 42 ft—makes the use of a floor panel attractive and where tempered ventilation air is desirable for good thermal environment.

View of the south wall showing a typical pressure relief opening just under the plate line. The roof extends about 8 ft beyond this wall, hence the opening is well protected from the weather. In the original design of the building a pressure relief opening was incorporated in a skylight running along the roof ridge



FUEL RESOURCES—

[*Concluded from page 75*]

and liquid fuel reserves. Here again the gas turbine may offer a solution. Under the sponsorship of the Locomotive Development Committee an efficient coal-burning gas turbine locomotive is being developed. Many problems must be solved in an undertaking of this nature but the results so far have been encouraging.

In power plants employing steam turbines and diesel engines much energy is thrown away in the exhaust because of the difficulty of recovering such low grade heat and putting it to a useful purpose. In a gas turbine, however, the exhaust gases possess a relatively high temperature so that energy is readily recoverable from them. Such hot gases can be used to make steam.

In the event of exhaustion of our fluid fuel reserves the most obvious remedy, based on present knowledge, for domestic and other heating would be to use coal. It is possible, however, that synthetic fuel processes will be sufficiently advanced by that time so that the convenience of fluid fuels can be economically retained. Before the end of the century solar heating will be used to a much greater extent than at present, and it is even reasonable to expect that homes may be heated by electricity. The rapid progress being made in the power generation field would indicate such a possibility. The fact that electric power is one of the few commodities that has not increased in price during the last decade is a tribute to this industry. Further advancements using gas turbines, nuclear energy, and other new developments should continue this trend ever forward.—JOHN T. RETTALIATA, dean of engineering, Illinois Institute of Technology, in an address at the United Nations Scientific Conference on the Conservation and Utilization of Resources, at Lake Success, N. Y.

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JOHN HANCOCK MUTUAL LIFE INSURANCE CO

Builds Air Conditioned Home Office

By D. C. Miller
Buerkel & Co., Inc., Boston

THE NEW home office building of the John Hancock Mutual Life Insurance Co. indicates by its size and architectural lines the stability of this old Boston firm.

It incorporates many modern features. For example, it offers "the longest moving stairway ride in an office building anywhere in the world," for 16 electric stairways extend from the basement to the eighth floor and down again. A one-way trip in either direction takes but 2½ min. High speed elevators also serve the building. Snow melting is another up-to-date feature; 720 ft of broad pavement surrounding the building has installed in it a continuous grid of wrought iron pipe through which warm water circulates when snow falls or ice begins to form. Mail—big item in an insurance company's operations—moves about the building in automatic conveyors.

The height of the building, not counting the television mast, is 409 ft, 6 in. above street level, holding second place in New England. The area covered at street level is 63,750 sq ft. Twenty-six stories rise above ground and there are three below.

The outer wall facing stone is Maine granite and Ohio sandstone. The colonnade is of polished granite. Window frames are of aluminum and double glass with a metal-to-glass seal is used throughout to reduce the heat loss in winter, heat gain in summer. Interior sides of exterior walls are of steel. Movable walls and partitions are also steel. Ceilings are acoustical metal pans. Finished floors are asphalt tile. Structural floors are cellular steel with lightweight concrete fill.

There is 625,000 sq ft of working floor space exclusive of mechanical equipment. Facilities include auditoriums, dining rooms, game rooms, shops, library, roof gardens, observation areas. There are accommodations for some 5000 employees.

The building is of course completely air conditioned. A few years ago, the air conditioning would no doubt have been considered a special feature. Today, however, complete air conditioning of big buildings must be considered as "standard equipment," for without it a building would be obsolete before completion.

The air conditioning system is designed for year 'round comfort, with sufficient capacity to maintain all of the occupied spaces at any normal desired temperature in the summer and winter. The maximum outside design conditions for summer cooling in the Boston area are 93 deg dry bulb and 76 deg wet bulb. The air conditioning installation has sufficient capacity to maintain 13 deg differential at maximum design temperatures. Cooling in the Boston area may be required in some years early in May and continuing until late in September.

With the "temperamental" New England climate, it is frequently necessary to supply alternate cooling and heating on succeeding days during the spring and fall seasons, due to rapid changes in outdoor temperatures. This can readily be taken care of by the 18 air conditioning systems. All of the air conditioning systems are built-up units, consisting of tempering

YEAR 'ROUND air conditioning, electric stairways, high speed elevators, automatic mail conveyors, interchangeable steel partitions, steel cellular floors, double glazing, employee dining and recreational facilities, an interior loading platform, a public address and music system . . . are all incorporated in the new 26 story home office building of the John Hancock Mutual Life Insurance Co. in Boston. The heating and air conditioning installation is described here

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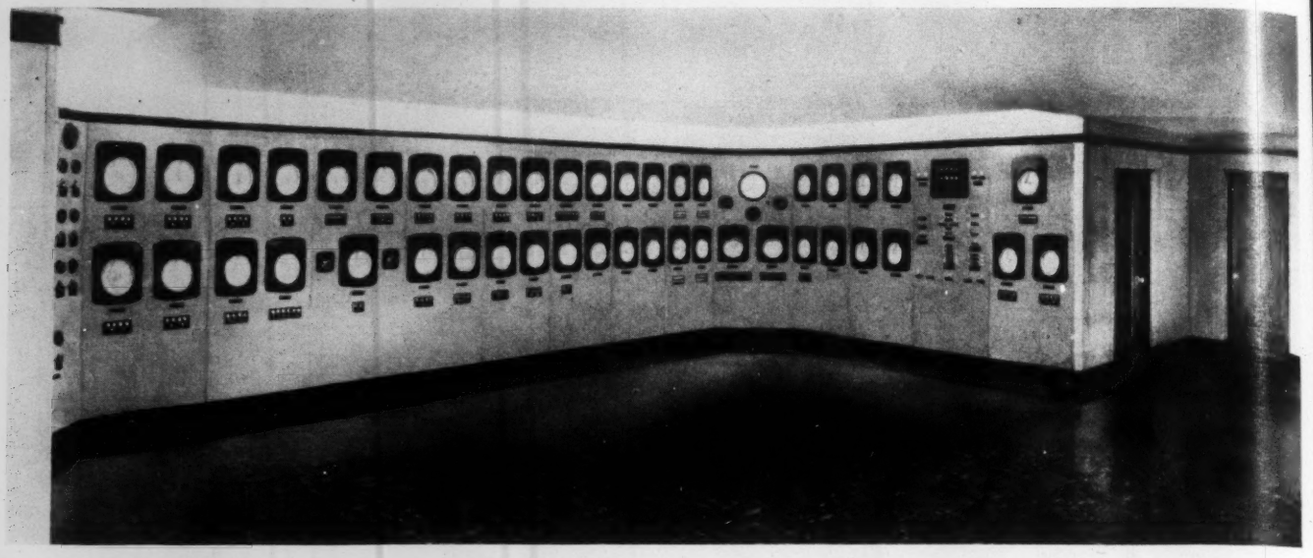


Central panel board, located in sub-basement adjacent to compressor room, with indicating and recording instruments for all air conditioning apparatus

coils, electrostatic air cleaners, surface dehumidifiers, and reheat or booster coils. Either warm or cooled filtered air may be supplied to any portion of the building within a short space of time.

570,500 Cfm of Conditioned Air

There are 26 occupied floors above ground, all of which are completely air conditioned, and two floors below ground. The several spaces in the two floors below ground are supplied with either conditioned air or tempered air, depending on the type of occupancy. The total volume of the conditioned spaces in the building is 7,240,000 cu ft, to which there is a constant supply of conditioned air at the rate of 570,500 cfm. This air is delivered from a total of 25 supply fans.

In addition to the supply fans, there are 31 return air and exhaust ventilation fans used in conjunction with the supply fans, or for exhaust ventilation only, in spaces such as paint shops, elevator machine rooms, the trucking area, etc. All of the toilet rooms are provided with mechanical exhaust ventilation connected to some one of the nine toilet vent fans. Exhaust ventilation from the several kitchens is handled by five fans with a total of 42,000 cfm of air being exhausted from the main kitchen serving the employee dining rooms.

1600 Tons From Three Centrifugals

Cooling for the air conditioning systems is accomplished by means of three centrifugal compressors having a total capacity of 1600 tons of refrigeration. The compressors are all in the sub-basement; there are two 700 ton units and one 200 ton unit. Cooling of the condenser water for the compressors is accomplished by means of three spray filled, induced draft type, cooling towers located entirely within the roof space above the 26th floor. Two of the cooling towers are used in conjunction with the two 700 ton compressors and the third is for the 200 ton unit.

Air is drawn into the cooling towers through louvered openings in the exterior building wall, these louvers being located immediately above the 26th floor ceiling and extending around the entire perimeter of the building.

Within the building there is a modern assembly hall having sufficient seating capacity to accommodate 1132 persons. The assembly hall will frequently be in use during the evening and on many weekends when the remainder of the building is closed. It was decided, therefore, to install the 200 ton compressor and cooling tower, together with a separate chilled water pump, condenser water pump, and air conditioning apparatus for use of the assembly hall only so that conditioning of this space is independent of the remainder of the building.

Condenser water for the two 700 ton compressors is circulated to the cooling towers by means of three pumps having a capacity of 2250 gpm each; one of the pumps is a standby unit in the event of failure of either of the other two pumps. Operating together with the condenser water pumps there are three chilled water pumps having a total combined capacity of 2650 gpm.

Due to the many varying load conditions on the 26th floor, where the glassed-in observation gallery is located, it was decided to install a separate system for air conditioning this floor. This is a direct expansion system of cooling with two reciprocating type compressors having a capacity of 20 tons each, with an evaporative condenser unit installed close by. This apparatus is located on the 27th floor.

Air Conditioning Motors Total 2600 Hp

The total electrical load for all motors connected to the air conditioning equipment is 2600 hp. Of this total, 1640 is for refrigeration compressors, 460 for fans, 340 for chilled and condenser water pumps, and 90 for cooling tower fans. The balance of the electrical requirements for the air conditioning apparatus is for the circulation pumps on the 18 surface dehumidifiers and the electrostatic air cleaners.

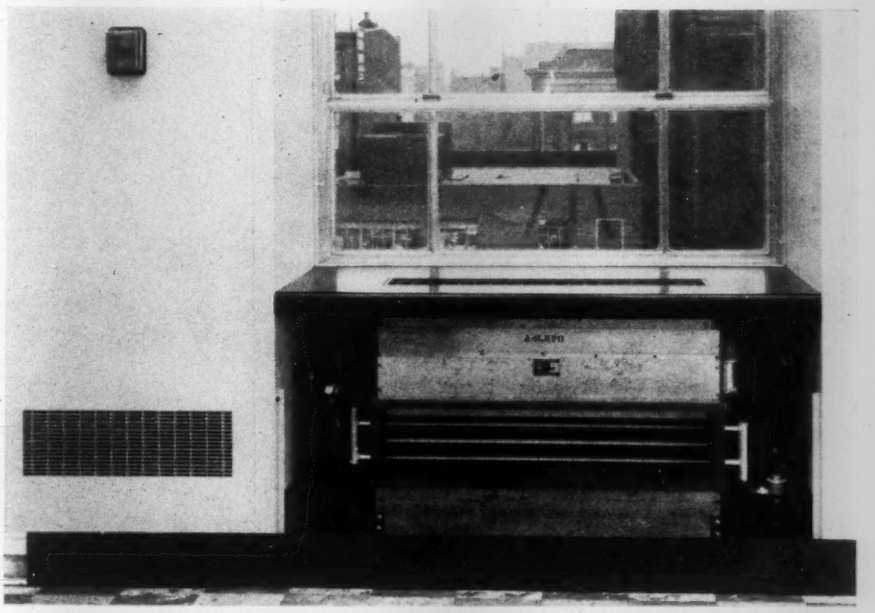
The fabrication of the ducts for the several air conditioning and exhaust ventilation systems require 250 tons of sheet aluminum, 195 tons of galvanized sheet iron, and 32 tons of heavy gage black iron sheets. This is the equivalent of a total of 849 tons of galvanized sheet iron.

The entire kitchen exhaust ventilation system is constructed of No. 11 gage steel with frequent access doors installed to facilitate cleaning after the system is in use. These ducts are insulated with 1 in. thick high temperature magnesia blocks for protection in the event of fire within the kitchen exhaust ducts. All kitchen exhaust systems are extended up through the building in masonry enclosed shafts and discharge at a level above the last occupied floor. All of the conditioned air supply ducts and exposed return air ducts are insulated with cork, covered with magnesia cement.

Five Vertical Zones

It was decided to centralize, as much as feasible, the location of all air conditioning and other mechanical apparatus and with this in mind the building was first divided into five vertical zones. Each of the five vertical zones was then divided by compass points with a further division for internal and external spaces, wherever required by the large open floor spaces. Each of these areas is served by a separate apparatus, located either in the sub-basement, 15th floor, or 27th floor apparatus rooms.

Air is supplied to the internal conditioned spaces by means of rectangular or square ceiling diffusers and to the external spaces through a combination heating and air conditioning unit located under each window. Air to the window type units is supplied from ducts located in the ceiling below and is introduced into the room by grilles in the window stools. There is a total of 1250 of these window type units located throughout the building.



Typical combination heating and air supply unit under each window, with front panel removed. This window, like the others, is glazed with double paned insulating glass to reduce heat transmission, condensation, and fogging

The quantity of air supplied in all spaces is varied by means of an automatically controlled damper in each unit, which is operated by means of a room thermostat. This thermostat is also used to control a steam supply valve which supplies steam to a finned heating coil in each of the window units. Air is returned to the apparatus from the conditioned spaces through grilles on the exterior walls and through the center portion of the combination supply and return ceiling diffusers.

During the winter months, heat is supplied to the building by tempered air through the air conditioning systems and by means of both steam heated convector radiators and the window heating units. The building heating system is a vacuum type, with five duplex vacuum pumps for the several zones.

The main entrance lobby to the first floor, the entrance lobby to

Typical floor, showing openings through steel girders for conditioned air ducts. All openings in steel girders are reinforced and fireproofed around ducts. All ducts passing through steel girders are insulated with 1½ in. thick magnesia blocks and ½ in. thickness of asbestos cement

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Typical open floor with ceiling diffusers, combination heating and air conditioning units under windows, and return air grilles in outside walls between windows

the assembly hall, and the large trucking area on the first floor are all heated by separate systems of forced circulation, hot water radiant heating. The pipe coils of these systems are of the grid type, with the coils embedded in the floor slab.

The entire sidewalk area on the three sides of the building has forced circulation hot water coils for snow melting. These coils are of the grid type, wherever possible, with the coils set on crushed stone and in the concrete slab. This snow melting system will save many dollars per year for snow shovelling (as well as many backaches).

Steam Supplied by Contract

Steam for heating the building is supplied by contract, either from street service or from the present boiler plant installed in the owner's adjacent building. Steam is brought into the building at approximately 100 lb pressure and is reduced to 40 lb through two reducing valves. These valves are sized for one-third and two-thirds of the total steam capacity for the entire building.

The 40 lb steam is carried to two steam headers, one of which is used for year 'round services (such as kitchen equipment and domestic hot water) and the other is for cold weather services, such as building heating, air conditioning apparatus, snow melting systems, and radiant heating systems. Steam at 40 lb pressure is supplied from the main sub-basement steam room to the pressure reducing valves and steam distributions headers located on the 15th and 27th floors.

Big Control Board Aids Operation

The entire heating and air conditioning installation is automatically controlled by a pneumatic temperature regulating system. This system is of the dual day and night control type, with the building divided into 16 zones. Any one of these zones may be operated at either day or night temperature settings by means of control switches located on a central control board in the sub-basement adjacent to the compressor room.

The central control board consists of 17 steel panels on which are mounted indicating and recording thermometers for each of the 18 air conditioning apparatuses. In addition, there are approximately 150 pilot lights to indicate the operation of all electric motors on heating, ventilating, and air conditioning apparatus.

The building was designed by Cram and Ferguson, architects and engineers. The builder was the Turner Construction Co. Buerkel & Co., Inc. were the engineers in charge of heating, ventilating, and air conditioning.

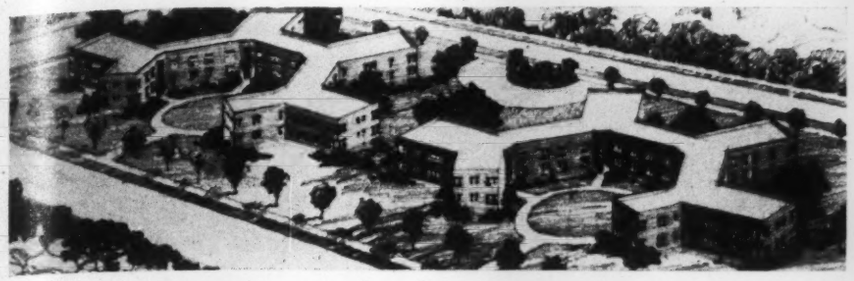
LIQUID METALS HEAT TRANSFER INVESTIGATED

A liquid metals heat transfer project, with implications in the generation of power from nuclear fission, is under way at the University of Delaware, in cooperation with the Office of Naval Research.

Under contract to the ONR, the university will continue its research to determine film or surface coefficients of heat transfer between steel tubes and liquid metals.

James I. Clower, professor of mechanical engineering, who is general consultant on the project, explained that while the direct generation of mechanical power or of electricity from a nuclear reactor is not feasible at present, the use of a reactor as a primary heat source from which steam or mercury vapor can be generated is feasible. Several experimental atomic power plants are now under construction. The only major difference between these plants and corresponding modern steam plants will be the use of slight quantities of fissionable material in a small volume nuclear reactor, instead of the combustion of large quantities of fuel in a large volume furnace, to provide the necessary heat energy at high temperatures. A well designed reactor will require an estimated one twentieth of the volume of a modern steam boiler, and will consume less than one ten-thousandth of the volume of fuel.

A new type of heating element, capable of producing temperatures up to 1200 F, is being built as part of the project.



Radiant Heated Apartments Are Individually Controlled

By Walter G. Liebert, vice president and general manager, Radiant Heat, Inc., Easton, Pa.

THE PARKHURST apartments, comprising two buildings each with 40 living units, at Bethlehem, Pa., incorporate floor type radiant heating systems made up of steel pipe coils. The buildings are of masonry and steel construction.

Each room is individually coiled and each coil is manually controlled by balancing valves at the apartment manifold. The temperature of the apartment itself is automatically controlled by means of a thermostat operating a two-position motorized valve. Temperature of the heating supply water will automatically vary from 75 to 140 F, being regulated by means of an outdoor thermostat and reset control panel. This method of automatic temperature control was selected to achieve even room temperature conditions, for a difficult heating problem was posed by the star-shaped buildings and with individual apartments facing in eight directions.

To simplify the job of balancing and adjusting the flow of water in piping circuits, each apartment is furnished with individual coil manifolds. Furthermore, each group of three apartments throughout the structure (each of which has the same directional exposure) is strategically balanced at submanifolds in the basement. The problem of balancing was greatly simplified by this piping arrangement. Returns from the submanifolds are brought together at the main manifold in the boiler room.

Boiler equipment in each building consists of two oil fired steel boilers, piped in tandem. There are two circulating pumps per building, one operating and the other as standby. Cross-valving permits interchange of pumps.

The entire radiant heat system was gas welded with the exception of the screwed valves at the manifolds. Where required, and particularly on all vertical piping, welding fittings were used for short radius bends.

Approximately 71,000 lineal feet of steel pipe was used for both buildings.

Radiant heat was selected for the project for the following principal reasons:

1) With apartments of this size (they are of 3½ and 4½ rooms), it is extremely important to be able to use all available floor space.

2) Other similar projects that have passed through one or more heating seasons indicate that redecorating costs will be low due to the absence of dirt-carrying drafts.

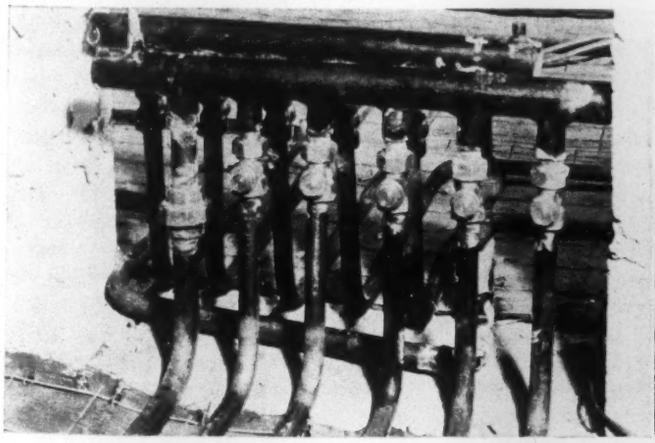
3) Fuel costs are expected to be at a minimum.

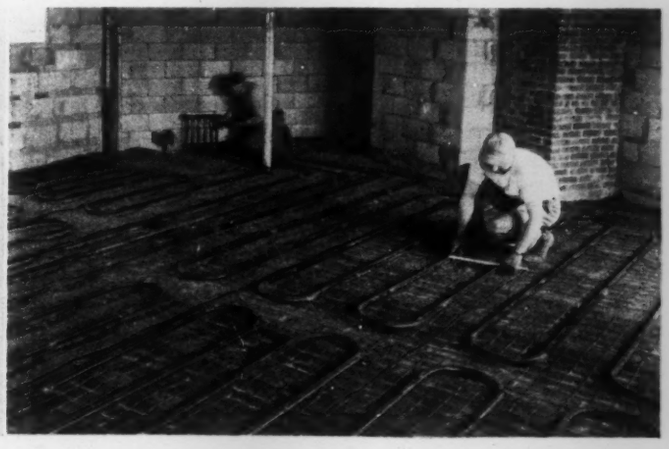
Reasons Nos. 1 and 2 are important to the economy of any apartment house operating budget, but they are especially significant to FHA financed projects where rents and operating budgets are government controlled during the mortgage period.

The radiant heating systems in both of the buildings were designed and installed by Radiant Heat, Inc., Easton, Pa. The architects were S. Harman Brown, Bethlehem, and P. Frederick Genther, Allentown, Pa. The owner is the Parkhurst Construction Co.

[Photos courtesy Bethlehem Steel Co.]

***Left*—Each room is individually coiled and each coil is manually controlled by balancing valves at the apartment manifold. *Right*—To simplify the job of balancing and adjusting the flow in the piping circuits, each apartment has individual coil manifolds and each group of three apartments having the same exposure is balanced at sub-manifolds**





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Snow Melting Piping System Serves Bridge Toll Houses

A mixture of antifreeze and water, circulated through piping in the pavement, keeps the approaches to the toll houses at the new Raymond E. Baldwin bridge over the Connecticut river skid-free

FRED S. DUBIN, consulting engineer, Hartford, Conn., describes Connecticut's first roadway radiant heating snow melting system, which he designed to keep the toll station approaches at the Raymond E. Baldwin bridge free of snow and ice

WHERE THE historic Connecticut river flows into Long Island sound, the new Raymond E. Baldwin bridge connects Old Lyme and Old Saybrook.

The Connecticut state highway department, working with the Old Lyme-Old Saybrook bridge commission, decided to incorporate a radiant snow melting system in the roadway at the approaches to the toll houses, and thus eliminate the possibilities of skidding and its hazards to motorists, attendants, and toll stations.

Radiant snow melting systems have been successfully applied to airplane runways, driveways, sidewalks, and even gutters. Thousands of dollars are saved every year in snow removal costs in these systems. This bridge installation is the first of its kind in Connecticut.

A mixture of heated antifreeze and water, circulated through wrought iron piping in the pavement, melts ice and snow, and keeps this section of the roadway skid-free all winter. The system was in use during the winter of 1948-49 and proved very successful. It was designed to melt up to 1.15 in. per hr of snow with a density of 0.49 lb per sq ft per in., or ⅛ in. per hr of ice. Observed results indicated that the snow melting system exceeded this melting rate by 15 or 20 percent last winter.

Another feature of this installation are the heating coils which are run parallel to and closely adjacent to the drainage trenches on each side of the toll stations, thereby preventing the clogging of these trenches by snow and ice. As the snow and ice are melted in the roadway, the water empties into the drain ditches and is carried away.

Oil Fired, Cast Iron Boiler Used

The radiant snow melting system is served by an oil fired, cast iron boiler, rated 557,000 Btu, installed in the basement of the new administration building which is located about 60 ft from the edge of the roadway. The boiler is fired with a gun type oil burner fitted with a 5 gph nozzle to burn No. 2 oil. This boiler is entirely independent of the heating system used to warm the administration building. A 3 in. supply main and a 3 in. return main are run from the boiler through an underground tunnel to the edge of the pavement, and then in a tunnel directly across the six-

lane highway. All piping in the tunnel is thoroughly insulated.

In the 8 in. pavement slab is embedded 2400 ft of 1¼ in. pipe, fabricated into 12 separate serpentine coils. Each coil constitutes a 10 x 17 ft road panel. The system is so designed that the first panel to be supplied is the last panel to be returned, so that the friction drop is equal in each road panel. Thermometers in the return line of each panel indicate the temperature in each section of the entire system.

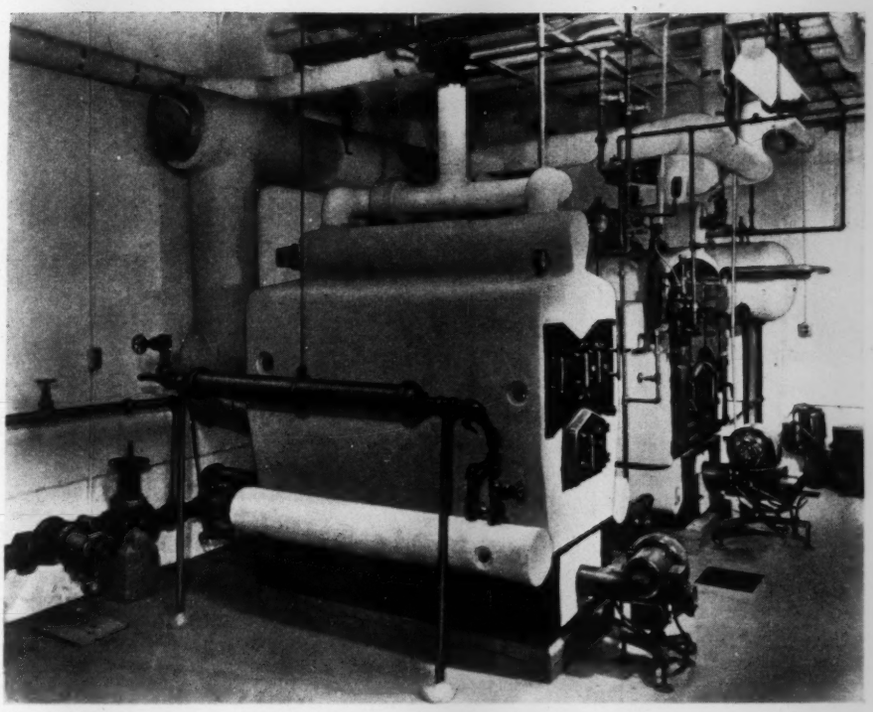
The coils are embedded approximately 3 in. below the surface of the roadway. The coils were run level, and were tested under 300 psi hydrostatic pressure for 24 hr before concrete was poured over them. The return line from each coil is equipped with a square head balancing cock so that equal flow can be obtained in each panel. The return piping from each two panels is extended up through the roadbed into a toll booth, joined together by a header, and vented by means of an automatic air valve. Both lateral and transverse expansion of the heated slab are taken care of by expansion joints in the roadway.

How Antifreeze Is Added

Three hundred gallons of a permanent type antifreeze is mixed with water in the system to prevent freezing in weather as cold as 30 deg below. An inhibitor added to the mixture prevents corrosion. The solution is circulated by means of a 3 in. high head centrifugal pump, powered with a ⅓ hp motor.

The specific gravity of the solution is periodically checked by means of an ordinary hydrometer. Provisions were made in the piping of the system so that additional quantities of antifreeze can be added when necessary without draining down the entire system. A standpipe in the return line, valved on both ends and equipped with a drain cock and fill funnel, is used for that purpose.

When it is necessary to add antifreeze, the valves on both ends of the vertical standpipe are shut, and the fluid is drained from the standpipe through the drawoff cock. A plug on top of the standpipe is removed, and pure antifreeze introduced into the standpipe. The plug is then inserted, both valves opened, and the circulating pump is started. This process is repeated until the desired specific gravity is attained.



An oil fired, cast iron boiler rated at 557,000 Btu and located in the basement of the administration building serves the snow melting system. It is entirely independent of the heating system for the administration building itself

At the first sign of snow or drizzle, the oil burner and pump are started simultaneously by means of a hand switch. The burner shuts off automatically if the temperature of the fluid in the boiler reaches 130 F. The pump continues to run until shut off manually.

It was found that a boiler temperature of 130 deg was sufficient to melt the ice and snow without any accumulation in the coldest weather. The melting snow and ice left no residue of water on the roadway, for the radiant heat dried the surface very rapidly.

The system has been designed for future expansion. A cast iron boiler was selected so that sections could be added when additional lanes are put in operation. The oil burner was sized for the future load, but for the present is equipped with a smaller nozzle. The boiler is sized approximately 50 percent larger than the load required, so that the pick up on any start is greatly accelerated, and the roadway is quickly warmed before snow or ice can get a firm foothold.

State and city officials are considering similar installations on other toll stations, dangerous grades, and overpasses.

Col. Howard S. Ives was the bridge project engineer for the state, and William Ford, Hartford, was the heating contractor. The author was the consulting engineer.

DRY ICE USED TO STOP FLOW IN PIPE

A. R. Lytle, of Niagara Falls, N. Y., writing in a recent issue of Linde Tips, which is published by the Linde Air Products Co., described the use of dry ice in stopping flow in piping temporarily.

"We were laying some underground piping and it was necessary to make a connection to a water pipe," he said. "It was impossible to shut off the water flow completely because the valve leaked slightly and permitted a small flow of water. This made it impossible to make the position weld that was necessary. As the pipe was only 3 in. in diameter, the water was flowing through too fast to permit building up a clog or mud dam.

"We cut a cylindrical piece of dry ice to fit the inside of the pipe. The piece was 6 in. long and fitted the inside of the pipe snugly. It was inserted about 6 in. from the end to be welded and it successfully stopped the flow of water for about 20 minutes. This was ample time to permit completion of the bottom half of this weld."

Railway Air Conditioning Problems

When the engineer or architect is given a job of designing and installing air conditioning equipment in a factory, store, theater, hotel, or similar building, such factors as source of power, water, space, heat losses, solar radiation, etc., can be accurately calculated and equipment provided to render satisfactory service.

When such an installation is made on a railway passenger car, there are many problems that have to be considered and the solution is not always satisfactory at all times. Some of the problems are power supply, space and weight restrictions, air distribution, heavy ventilation load requiring high capacity heating and cooling systems, heat loss as affected by speed and insulation, solar radiation and window area, changing locality with resultant temperature and altitude changes, human heat load variation in comparative small space, and the human element in operation of equipment.

The power supply in general use today is a 32 volt generator or generators of 10 or 15 kw, voltage regulator to control the voltage and limit battery charging, and a storage battery of 1000 to 1500 ampere hour capacity. The power supply factor is governed not solely by the air conditioning load, but by the total connected load, which includes incandescent lamp load, motor alternator for fluorescent lights where used, electric water coolers, water circulating pump motor, and motor alternator where cars are equipped with radio, wire recording, and like equipment. All cars are equipped with connectors and receptacles so that in case of generator or battery failure, power may be obtained from adjacent cars.

Space and weight are important factors on modern lightweight cars, as it is desirable to maintain a certain amount of space for passenger pay load, but all new innovations and appliances require space and have weight. At present, most of the cars are built with the air conditioning unit or evaporator and tempering coil with air circulating fan, dampers, plenum chamber and filters, above the men's smoking room and adjacent hallway. The air distribution duct is in the center of the car between the ceiling sheet and roof frame. The refrigeration unit is mounted under the car and located for servicing and to balance the weight of other equipment on the opposite side.

Air distribution in a passenger car would seem to be a simple process, but when you endeavor to balance the distribution of a car to 1½ deg temperature variation, it is not so simple. The fan delivers from 1400 to 2200 cfm—25 percent fresh air, 75 percent recirculated. Chair cars, lounges, diners, or open type cars use diffuser type units and the variation of the opening controls the distribution. In cars having rooms, the air vane type delivery is used, and the hallway used as the return, with air exhausting through grilles in the lower portions of the doors.

With the advent of high speed trains the problem of maintaining a somewhat constant pressure within the cars has become a serious problem. Baffles or scoops are installed in front of the fresh air intake on the roof of some cars to jet the air into the intake. When this is done the pressure will increase slightly at high speed. On the Santa Fe we are now testing 15 cars with a hood over the fresh air intake and a scoop, which in reality is a flat plate with a 5 deg angle centering at the center of the hood, forcing the air into the hood. Tests have shown it to be satisfactory up to speeds of 80 mph. If pressure is not maintained within the car, the doors will not stay closed, dirt will seep in around doors and windows; and one very obnoxious thing is that the water will blow back in the toilets when flushed with the train in motion.

Air filtration is of utmost importance, particularly on high speed trains that stir up clouds of dust from the road bed. At present our practice is to use three panel filters of expanded metal, wire mesh, or screen usually 4 in. thick, cleaned and oil impregnated at frequent intervals—and they are not entirely satisfactory. Some experiments have been made using electrostatic type filters, also high velocity air jet and oil bath types similar to aircraft and tank filters used in World War II.

Most cars are now insulated with fiber glass or other noncombustible material and we, on the Santa Fe, feel that the stainless steel exterior is a great help in reducing the solar load. The new cars, with large window area, greatly increase the solar load per car. I recently rode a car under test with representatives of other railroads and (using a potentiometer and some 20 thermocouples, placed at strategic points on the car) we found the temperature on the sunny side of the car at window to be 112 F, the shady side 73 F, and air temperature 69 F. The heat load on a car also varies insofar as human body heat is concerned, due to the fact that at times the passenger load may only be 12 to 15 people, while a car fully loaded will have 56 people, and on the basis of 400 Btu per person, the variation in heat load can readily be seen.

The human element very definitely enters into the operation of air conditioning equipment, as at various points along the line train crews are changed and regardless of how many instructions they have received (either orally or written) they all have different ideas on how to operate the equipment. Then, too, every time a passenger complains about being too hot or too cold, they endeavor to do something different. As we all know, no two people are comfortable at the same temperature—and those who are under the influence of alcohol are always too warm. Our thermostats, both the bimetallic and mercury tube type, are set for 75 F daytime operation, sleeping cars 71 F at night, and chair cars 78 F to compensate for lack of cover. Heating thermostats vary slightly from this temperature. In Pullman cars the temperature in individual rooms can be raised or lowered from 65 to 80 F.—J. V. Dobbs, assistant electrical and air conditioning foreman, Atchison, Topeka & Santa Fe Railway Co., Los Angeles, at a meeting of the Los Angeles section of the American Society of Refrigerating Engineers.

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Part of the big press room, showing the suspended central station type humidifier. Humidification during the winter months speeds the operation of the presses by reducing static, results in important money savings

Printer Expects Big Savings Due To New Air Conditioning

THE AIR conditioning installation recently completed in the plant and offices of the Safran Printing Co., Detroit, one of the largest printer-lithographers in the midwest, utilizes a minimum of equipment to meet maximum requirements in attaining the desired results. The job consists of six separate air conditioning systems, each designed to meet the needs of specific areas in the building.

Before this multiple system was selected, Vice President David Safran made an extensive investigation of process air conditioning for printing plants. Various organizations in the trade offered any number of solutions to his problem. After considerable correspondence with the editors of Heating, Piping & Air Conditioning, Mr. Safran decided to retain a consulting engineer to work out the various problems encountered in the design of the system.

Another important factor in the situation was the economic value of the right type of air conditioning. Mr. Safran estimates that with the proper type of humidifying equipment, press capacity can be increased at least 10 percent during 10 weeks of winter. When the relative humidity is not maintained, static electricity tends to slow down the presses, and frequent stoppages result. To obtain the desired results, it was also imperative that humidifying equipment be installed in the stock and bindery department.

Save $6000 to $8000 Each Winter Month

Based on the operation of 30 large printing presses, Mr. Safran estimates that the installation of humidifying equipment will result in savings of from $6000 to $8000 per month during the winter season. He also estimates that similar savings will be made in the camera and lithoplate room, where lithograph plates are made. As a result, he feels that the installation of the right type of air conditioning equipment will pay for itself in about two years, and become one of the best investments the company has ever made.

General offices of the company have been provided with summer cooling only, as they were already equipped with steam heating. A central station system handles 4000 cfm.

To facilitate the handling of photograph materials and to keep lithograph plates in perfect register, the camera and lithoplate department is equipped for summer cooling, dehumidification, and winter heating. The equipment consists of a vertical air handling unit having a capacity of 8000 cfm that is located in a penthouse especially built for the purpose. Summer cooling is supplied by a 20 hp direct drive compressor. Winter heating is obtained from two gas fired duct heaters installed in the air unit. The system utilizes 25 percent outdoor air.

The composing room has a similar system, being equipped with a 4000 cfm air handling unit and two gas fired duct heaters. Cooling is supplied by a 7½ hp compressor.

Heating and cooling in the shop office is supplied by a 3 hp self contained cooling unit, equipped

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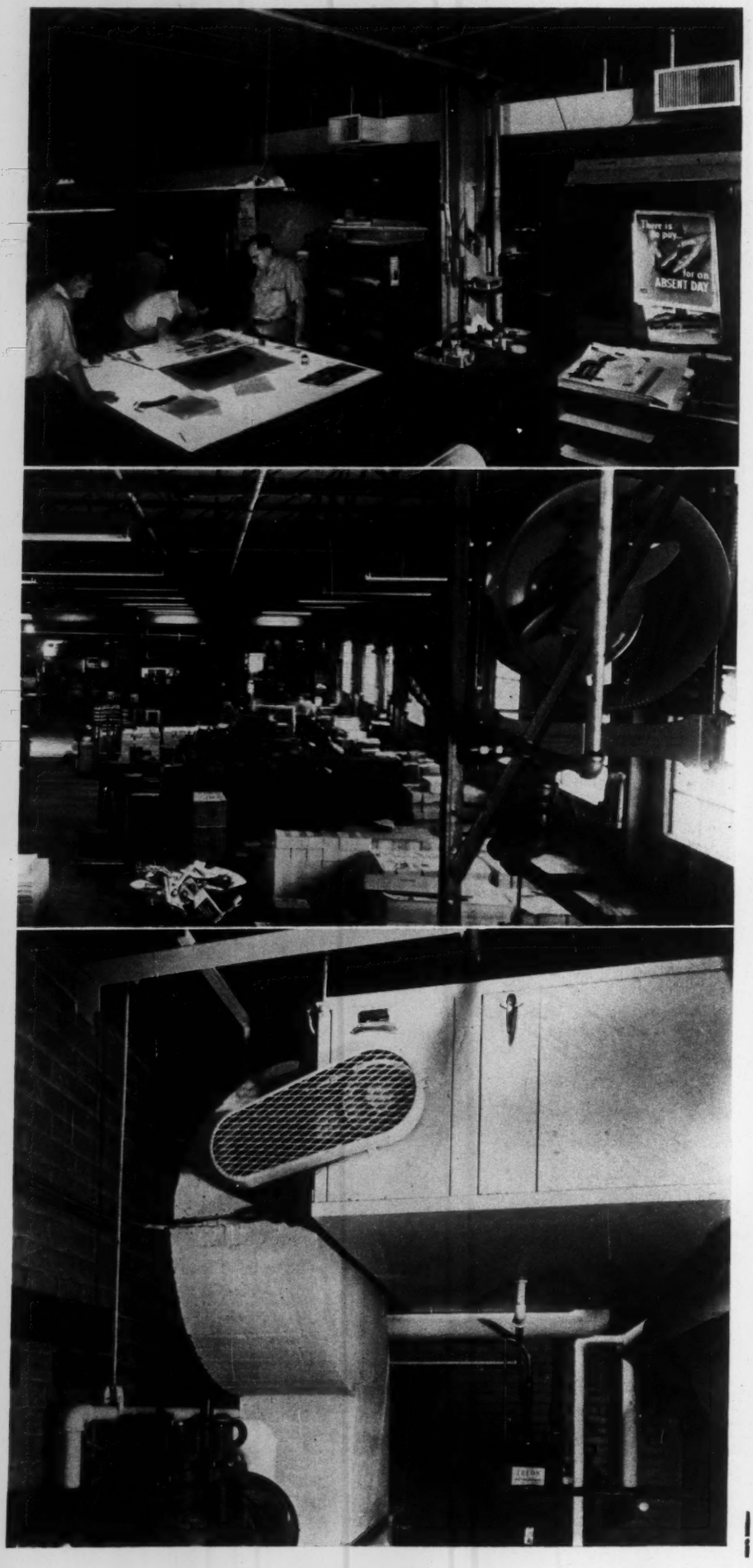

with a duct heater. This entire system is extremely compact and is located in a small closet adjacent to the room.

A central station humidity unit serves the press room. It utilizes 100 percent outdoor air, and is equipped with a fan which handles approximately 5000 cfm. It also has two gas fired duct heaters. Air distribution is by means of an exposed duct system equipped with diffusing grilles.

Any printing company doing the volume that Safran does naturally has a tremendous inventory of paper stocks and it is essential that these stocks be kept in approximately 50 percent relative humidity. To accomplish this, the consulting engineer specified five centrifugal humidifiers. These units are suspended from the stock storage and bindery department where they atomize water to a fine mist and diffuse an air and water mixture.

Control of relative humidity in both the press room and stock department is by means of a humidity control panel.

With these six individual systems in operation, the Safran Printing Co. has an economical system for year 'round comfort and efficiency for the office, camera room, and composing room, and a system which eliminates the static electricity problem in the press and stock storage areas.

All equipment specified by Clarence Toonder & Associates, the consulting engineer, was installed by Mechanical Heat & Cold, Inc., also of Detroit.

***Top*—Highly skilled employees in the lithoplate engraving room are able to work at peak efficiency since air conditioning has been installed. The air is distributed through exposed duct systems and diffusing type grilles. *Center*—Stock in the paper storage rooms is kept in the proper condition by means of a series of suspended type unit humidifiers, as shown here. Humidistats maintain the right relative humidity. *Bottom*—To conserve valuable space, some of the air conditioning equipment was placed in a penthouse adjacent to the areas served. The condensing units shown supply refrigeration to the 4000 cfm conditioner above them**

How to S-p-a-c-e

PIPE SUPPORTS

THIS ARTICLE has been written to present a rational method for determining the spacing of pipe supports. It should be especially useful to designers who wish to make a highly refined analysis for those instances in which it is desired to place the supports as far apart as possible.

The author has recently been involved in the design of several hundred miles of outside pipe lines for a series of large process industry plants. In this work, the economical spacing of pipe supports was of major importance, and a great deal of time was spent in studying the problem. It was very surprising to find that much of the literature on the subject was ultraconservative, and in many cases obvious errors were noticed. As a result of considerable study, a design procedure was developed; and it is reported here for the benefit of others who may have use for it. In addition to developing a theory, a means for quickly applying the theory to everyday problems is presented. Sample problems are included to further explain the use of the method.

Three Criteria for Support Spacing

There are three criteria which are commonly used to determine the spacing of pipe supports—deflection, slope, and stress.

It is believed that the first of these, deflection, does not give a rational basis for design. It is probably a carryover from structural practice, and it will not be discussed further except to state that the author has successfully designed a very great deal of piping in which the deflection was not even figured. In some cases, deflections of 4 and 5 in. were actually measured in the field, and no trouble from this source has been reported.

The second criterion, slope, is not usually a limiting factor. It is ordinarily possible to give the piping the slope required for draining, and some piping does not have to be drained. To facilitate the design, a theory is developed in the following paragraphs which will enable the designer easily to calculate the slope required to drain piping.

The third criterion, stress, is usually the limiting factor, and most of the discussion which follows is devoted to the problem of calculating stress. The spacing of the piping supports affects, directly, only the bending stress in the piping. It is, however, necessary to combine this bending stress with other stresses to obtain the combined equivalent stress—as will be more fully explained later.

Alignment Chart Aids Calculations

Fig. 1 was prepared to assist in the calculation of both slope and bending stress for a bare empty steel pipe. The piping will usually carry additional weight in pipe covering and also the weight of the fluid in the pipe. Therefore, the values of stress and slope obtained from the chart must be multiplied by the ratio of weights: actual weight divided by the weight of bare empty steel pipe. The weights may be obtained from Table 1. For materials other than steel, the results are corrected by the factors obtained from Table 2.

Most of the balance of this article will be devoted to developing the formulas on which Fig. 1 is based; in proving that some spans are to be considered fixed and others are to be considered freely supported; in showing how the various stresses in the piping are combined to give the total equivalent stress; and (finally) sample problems will be included to demonstrate how the

THEODORE E. BRIDGE, a mechanical engineer with the University of Chicago in connection with a project under construction for the Argonne National Laboratory, acquired a wide experience in the design of power and of process piping during 15 years with E. I. du Pont de Nemours & Co.; he has also had experience in the field of very high pressures. In his article (of which this is the first part) he presents a rational method for determining the spacing of pipe supports. The data are of particular value in those instances where it is desired to place the supports as far apart as possible. Little information on the matter is available elsewhere

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method works. Most of the data needed to solve actual problems are included in the tables and figures for ready reference.

There are four formulas used in the construction of the alignment chart shown in Fig. 1. The first and second formulas are used to calculate the slope required to drain fixed spans and free spans respectively; the third and fourth formulas are used to calculate the stress in a bare empty steel pipe for fixed and free spans, respectively. In the first and third formulas, the distance between the supports for the fixed spans is taken as L; while in the second and fourth formulas, the distance between the supports which are considered as freely supported is taken as L'. Actually, no span is completely fixed at the supports and no span is entirely free; the true condition usually lies somewhere between the two extremes. Later paragraphs will show which actual conditions are considered fixed, and which free.

It is not difficult to use Fig. 1. A straight line is simply drawn across the face of the chart intersecting the D scale at the point which indicates the mean diameter of the pipe. This line is also made to intersect the adjacent scale at the point which will indicate the proper value for L, the length of a fixed span, or L', the length of a free span, depending on which condition is assumed to apply for the span in question. The intersection of the above line with the next scale will indicate the proper value for the stress, S, in a bare empty steel pipe. Also, the intersection of the above mentioned line with the left hand scale will indicate the slope required to drain a bare empty steel pipe (Z for fixed spans, and Z' for spans that are considered to be freely supported). The sample problems included at the end of this article will further clarify this procedure.

It is usually possible to locate concentrated weights, such as valves and fittings, at points where the bending moment is low and near the supports where they will have a negligible effect on the stress in the piping. Fig. 1, therefore, makes no allowance for additional concentrated loads on the system. In special cases, it may be necessary to evaluate the effect of such additional loading.

Development of a Formula for Calculating the Slope Required to Drain a Pipe With Fixed Supports—By referring to Fig. 2, it will be seen that a uniform loading is assumed. One learns, from the basic beam theory, that the load diagram may be integrated to obtain shear as given in the following: (Note that the origin is taken in the center of the span.)

$$\text{Shear} = V = -W X + Vo \quad \ldots [1]$$

It is obvious that the shear in the middle of the beam is zero. Therefore, $Vo = 0$. The bending moment M is obtained by integrating the shear diagram as follows:

$$M = Mo - W X^2/2 \quad \ldots [2]$$

The sign is arbitrary; bending moment which tends to make the beam bend so as to hold water is considered plus. Mo is an integration constant which will be determined later. One learns further from the basic beam theory that the bending moment can be integrated to obtain the slope as expressed in the following, where slope $= (dy/dx)$:

$$(E\,I/144)\,(dy/dx) = Mo\,X - W\,X^3/6 + Co \quad \ldots [3]$$

By referring to Fig. 2, from conditions of symmetry, one knows that the slope is zero at the center of the beam where $X = 0$. From this, it is seen that the integration constant Co is zero. One also knows, from the assumption of fixed supports, that the slope is zero at the end of the beam where, $X = L/2$. This enables us to solve for the constant Mo:

$$Mo = W\,L^2/24 \quad \ldots [4]$$

SYMBOLS

C = the term, $(E\,I/144)\,(dy/dx)$ which is proportional to slope.
c = the corrosion allowance, in. (usually taken as 0.065).
dy = differential change in deflection, ft.
dx = differential length of beam, ft.
D = mean diameter of pipe, in. $D = D' + t$.
D' = inside diameter of pipe, in.
D'' = outside diameter of pipe, in.
E = Young's modulus of elasticity, psi.
I = moment of inertia of pipe section, in.^{4}
K = ratio of outside to effective inside diameter. $K = D''/(D'' - 2t' + 2c)$.
L = distance between fixed supports, ft.
L' = distance between free supports, ft.
M = bending moment, ft-lb.
P = the design pressure of the fluid in the pipe, psi.
S = bending stress, due to its own weight, in a bare empty steel pipe, psi.
S'' = bending stress, due to the total weight of pipe, contents, and insulation, psi.
Sa = axial stress caused by pressure in the pipe, psi.
Sb = resultant bending stress in the pipe, psi. $Sb = \sqrt{Sv^2 + Sh^2}$
Se = the equivalent stress obtained by combining all of the other stresses in the pipe according to the maximum shear theory (note that this is sometimes called the double shear stress), psi.
Sh = the horizontal component of the bending stress, psi.
Sp = the hoop tension in the pipe wall caused by pressure in the pipe, psi.
Sr = the radial stress in the pipe wall caused by pressure in the pipe, psi.
St = the bending stress caused by thermal expansion of the pipe, psi.
Sv = the vertical component of the bending stress in the pipe, psi.
T = the shear stress caused by twisting of the pipe due to thermal expansion, psi.
t = the nominal thickness of the pipe wall, in.
t' = the minimum thickness of the pipe wall, in.
t'' = the thickness of the pipe covering, in.
V = the vertical shear loading on the pipe, lb.
W = the weight of bare empty steel pipe, lb per ft.
W' = the wind loading on the pipe, lb per ft.
W'' = the total weight of the piping as installed including contents and covering, lb per ft. $W'' = W + Wc + Wi$.
Wc = the weight of the fluid in the pipe, lb per ft.
Wi = the weight of the pipe covering on the pipe, lb per ft.
X = the distance of any point on the pipe from the origin, ft.
y = the deflection of the pipe at any point X ft from the origin, ft.
Y = a term proportional to deflection $= (E\,I/144)\,y$.
Z = the slope required to drain a bare empty steel pipe with fixed supports, percent. This is taken as double the maximum slope calculated for the pipe in order to allow for possible misalignment during erection.
Z' = the slope required to drain a bare empty steel pipe with free supports, percent.
Z'' = the actual slope required to drain the pipe as installed with the weight of the covering included, percent.

The subscript o indicates conditions at the origin, where $X = 0$.

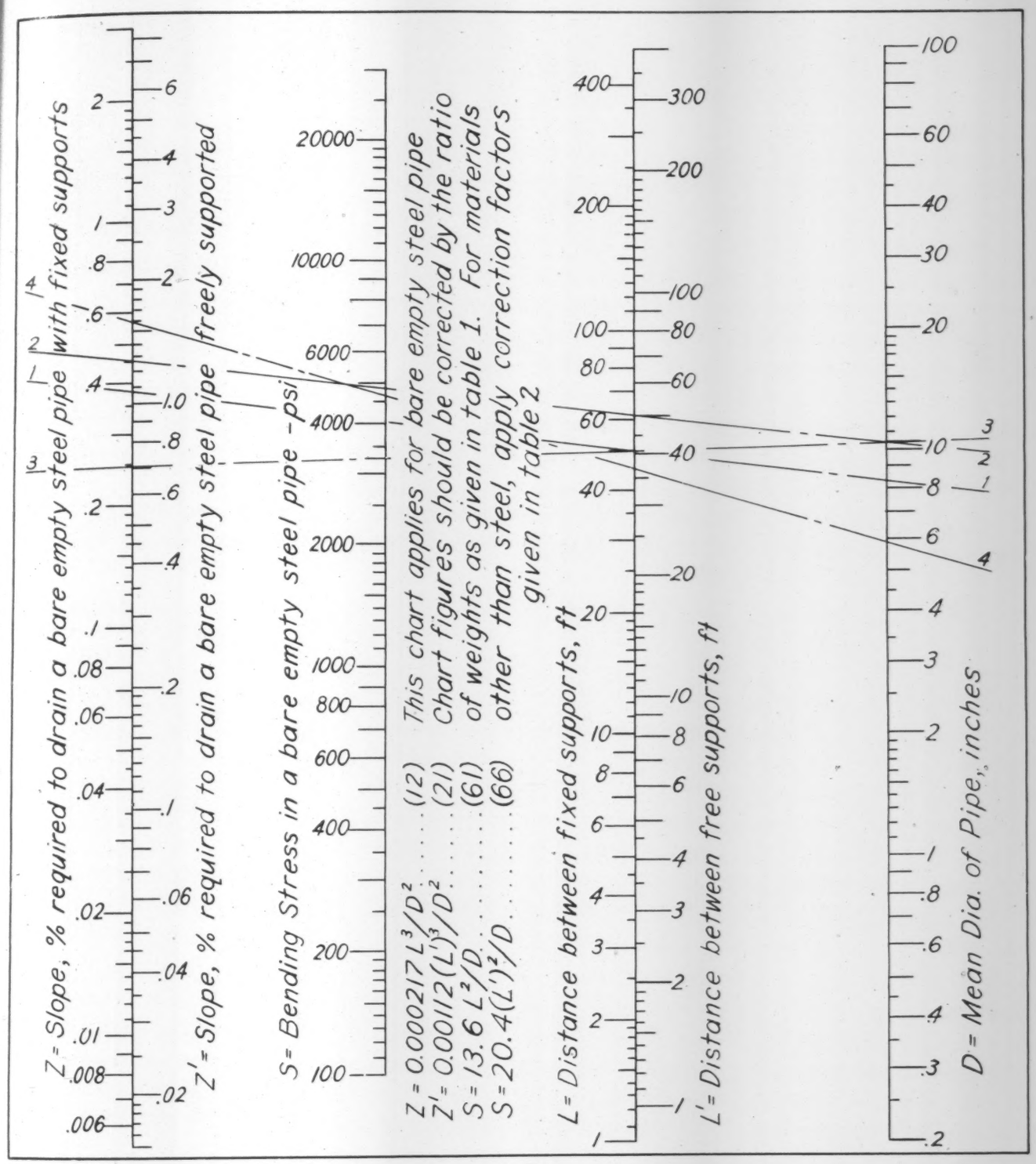
Z = Slope, % required to drain a bare empty steel pipe with fixed supports
Z' = Slope, % required to drain a bare empty steel pipe freely supported
S = Bending Stress in a bare empty steel pipe - psi
Z = 0.000217 L³/D² ..... (12)
Z' = 0.00112 (L')³/D² ..... (21)
S = 13.6 L²/D ..... (61)
S = 20.4 (L')²/D ..... (66)
This chart applies for bare empty steel pipe
Chart figures should be corrected by the ratio
of weights as given in table 1. For materials
other than steel, apply correction factors
given in table 2
L = Distance between fixed supports, ft
L' = Distance between free supports, ft
D = Mean Dia. of Pipe, inches

Fig. 1—Chart used to determine the maximum spacing of pipe supports

Substituting Equation [4] into Equation [2]:

$$M = W L^2/24 - W X^2/2 \quad \ldots\ldots [5]$$

Substituting [4] into [3]:

$$(E I/144)(dy/dx) = W L^2 X/24 - W X^3/6 \quad \ldots [6]$$

It can be shown that the plot of the integral of any function will reach maximum and minimum values at points where the original function is equal to zero. This tells us that the slope will be at a maximum at the point of inflection on the beam where the bending moment is zero. It then remains to solve Equation [5] for X, while making $M = 0$:

$$X = L/\sqrt{12} \quad \ldots\ldots\ldots\ldots\ldots [7]$$

Substituting [7] into [6]:

$$(E I/144)(dy/dx)_{max} = W L^3/24\sqrt{12} - W L^3/72\sqrt{12}$$

$$(E I/144)(dy/dx)_{max} = W L^3/36\sqrt{12} \quad \ldots\ldots\ldots [8]$$

Let Z equal the slope in percent required to drain the pipe. Also, incorporate a factor of safety of 2 in the value for Z to allow for some misalignment of the piping during erection. Therefore, $Z = 200(dy/dx)_{max}$, which may be substituted in

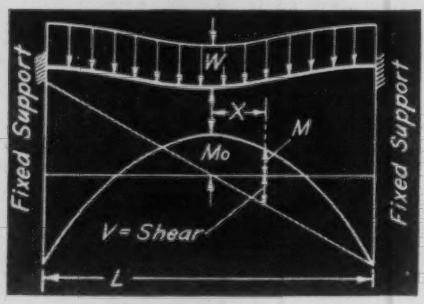

Fig. 2—Bending moment diagram for a beam with fixed supports. W = load on the beam, lb per ft; M = bending moment, ft-lb; V = shear, lb; L = distance between supports, ft

[8] to give the following:

$$Z = 231\,W\,L^3/E\,I \quad \ldots\ldots\ldots\ldots [9]$$

Equation [9] will apply to a pipe of any material and loading. A simpler formula giving the slope required to drain a bare empty steel pipe is developed as follows:

For empty steel pipe,

$$W = 3.4\,\pi\,D\,t \quad \ldots\ldots\ldots\ldots [10]$$

The moment of inertia,

$$I = \pi\,D^3\,t\,/\,8 \quad \ldots\ldots\ldots\ldots [11]$$

t, in the above equations, is the wall thickness of the pipe section. For steel, the modulus of elasticity, E, = 29,000,000 psi. Substituting Equations [10] and [11] in [9]:

$$Z = 231\,L^3\,3.4\,\pi\,D\,t\,8\,/\,\pi\,D^3\,t\ \ 29{,}000{,}000$$
$$Z = 0.000217\,L^3\,/\,D^2 \quad \ldots\ldots\ldots\ldots [12]$$

Equation [12] is the first formula used in the construction of the alignment chart in Fig. 1. The value of Z obtained from the chart must be corrected by the ratio of weights to give the required slope for the actual piping system:

$$Z'' = Z\,(1 + Wi/W) \quad \ldots\ldots\ldots [13]$$

Values for the weight of the insulation, Wi, and the weight of the bare pipe, W, may be obtained from Table 1. It is not necessary to consider the weight of the fluid in the pipe when correcting the chart figures for slope, because, as the contents are drained from the pipe, it will spring back to its empty position, which is the condition assumed in Equation [13].

Development of a Formula for Calculating the Slope Required to Drain a Pipe With Free Supports—By referring to the diagram in Fig. 3, it will be seen that a uniform loading is assumed. One learns from the basic beam theory that the load diagram may be integrated to obtain the shear diagram. Note that the origin is taken in the center of the beam.

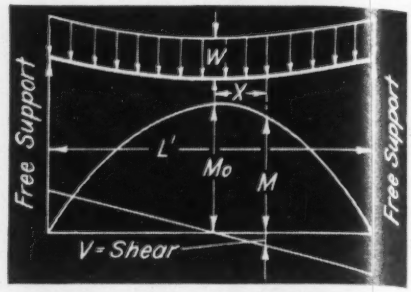

Fig. 3—Bending moment diagram for a beam which is freely supported. W = load on the beam, lb per ft; M = bending moment, ft-lb; V = shear, lb; L' = distance between supports, ft

$$\text{Shear, } V = -W\,X + Vo \quad \ldots\ldots [14]$$

From conditions of symmetry, it is obvious that the shear in the middle of the beam is zero, and therefore the integration constant, Vo, is equal to zero. The bending moment M may be obtained by integrating the shear as follows:

$$M = Mo - W\,X^2/2 \quad \ldots\ldots\ldots [15]$$

From the condition that the ends are freely supported, it is known that the bending moment is zero at the end of the beam; or $M = 0$, when $X = L'/2$. These values may be substituted in [15] to calculate the integration constant:

$$Mo = W\,(L')^2/8 \quad \ldots\ldots\ldots\ldots [16]$$

Substituting [16] in [15]:

$$M = W(L')^2/8 - W\,X^2/2 \quad \ldots [17]$$

It has been demonstrated in the basic beam theory that the bending moment may be integrated to obtain slope (dy/dx) as follows:

$$(E\,I/144)\,(dy/dx) = W(L')^2X/8 - W\,X^3/6 + Co$$
$$\ldots\ldots\ldots\ldots\ldots\ldots [18]$$

From conditions of symmetry, it

Table 1—Weights per foot of pipe in pounds

Diameter		1	1¼	1½	2	2½	3	4	6
Bare empty pipe									
Schedule	40	1.68	2.27	2.72	3.65	5.79	7.57	10.79	18.97
	80	2.17	3.00	3.63	5.02	7.66	10.25	14.98	28.57
	160	2.85	3.76	4.86	7.45	10.01	14.30	22.60	45.30
	XX	3.66	5.21	6.41	9.03	13.69	18.58	27.54	53.16
Water in pipe									
Schedule	40	.374	.647	.882	1.45	2.07	3.20	5.51	12.51
	80	.311	.555	.765	1.28	1.83	2.86	4.98	11.29
	160	.226	.458	.608	.971	1.53	2.35	4.02	9.16
	XX	.122	.273	.412	.769	1.07	1.80	3.38	8.14
Magnesia covering									
360 F	Std. th.	.65	.80	.85	1.25	1.35	1.55	2.10	2.90
440	1½ in.	1.45	1.60	1.75	2.05	2.30	2.65	3.15	4.15
525	2 in.	2.25	2.45	2.65	3.15	3.40	3.95	4.75	6.40
800	(Combi-)	3.70	4.10	4.20	5.80	6.60	8.30	9.80	14.90
1000	(nation)	3.70	4.10	4.20	7.40	8.50	10.70	12.20	24.20

Diameter		8	10	12	14	16	18	20	24
Bare empty pipe									
Schedule	10				37	42	47	53	63
	20	22.4	28.0	33.4	46	52	59	79	95
	30	24.7	34.2	43.8	55	63	82	105	141
	40	28.5	40.5	53.6	63	83	105	123	171
	60	35.7	54.7	73.2	85	108	133	167	240
	80	43.4	64.4	88.6	107	137	171	209	297
	120	60.7	89.2	125.5	147	193	239	297	416
	160	74.7	116.0	161.0	190	241	304	374	536
Water in pipe									
Schedule	10				62	82	105	130	188
	20	22.5	35.9	51.3	61	80	102	126	184
	30	22.2	35.0	49.7	60	79	100	123	178
	40	21.6	34.1	48.5	58	76	97	120	174
	60	20.8	32.3	46.0	56	73	93	115	166
	80	19.8	31.1	44.0	53	70	89	109	158
	120	17.6	27.9	39.3	48	63	80	98	143
	160	15.8	24.6	34.9	43	56	72	89	128
Magnesia covering									
260 F	1¼ in. th.	4.1	5.2						
360	1½ in. th.	5.3	6.6	9.6	10	12	13	14	17
440	2 in. th.	7.7	9.5	12.5	13	15	16	18	22
525	2½	10.3	12.3	15.5	17	19	21	23	27
600	3	12.5	14.2	18.8	20	23	25	27	32
800	(Combi-)	19.6	23.5	31.6	33	37	40	45	52
1000	(nation)	26.7	33.3	36.5	39	44	48	52	61

Table 2—Factors with which to correct the values obtained from the alignment chart in Fig. 1 for use with materials other than steel

	Correction factors	
	Slope	Stress
Aluminum	0.97	0.35
Brass	2.45	1.07
Copper	2.06	1.14
Chemical lead	27.6	1.43
Cast iron	2.21	0.916
Steel	1.00	1.00
Stainless steel	1.00	1.00
Monel metal	1.25	1.125
Nickel	1.09	1.13

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is known that the slope is zero when $X = 0$. Therefore, the integration constant $Co = 0$. It is also known that the slope is a maximum when the bending moment is zero, i.e. at the end of the beam where $X = L'/2$. Substituting in [18]:

$$(E\,I/144)\,(dy/dx)_{max} = W(L')^3/16 - W(L')^3/48 = W(L')^3/24 \quad \ldots\ldots\ldots\ldots [19]$$

Let Z' equal the slope in percent required to drain the pipe, and apply a factor of safety of 2 to allow for some misalignment of the piping during erection. Therefore, $Z' = 200(dy/dx)_{max}$ may be substituted in [19] to give:

$$Z' = 1200\,W(L')^3/E\,I \quad \ldots\ldots\ldots [20]$$

Equation [20] applies for piping of any material. It is convenient to develop a simplified expression for the required slope of a bare, empty, steel pipe.

$$W = 3.4\,\pi\,D\,t \quad \ldots\ldots\ldots\ldots\ldots [10]$$

$$I = \pi D^3 t\,/\,8 \quad \ldots\ldots\ldots\ldots\ldots [11]$$

For steel, $E = 29{,}000{,}000$. Substitute [10] and [11] in [20] to obtain:

$$Z' = 0.00112\,(L')^3/D^2 \quad \ldots\ldots\ldots [21]$$

Equation [21] is the second formula used in constructing the alignment chart in Fig. 1. The value of Z', as read from the chart, must be corrected by the ratio or weights to obtain the slope actually required to drain the piping.

$$Z'' = Z'\,(1 + Wi/W) \quad \ldots\ldots\ldots [22]$$

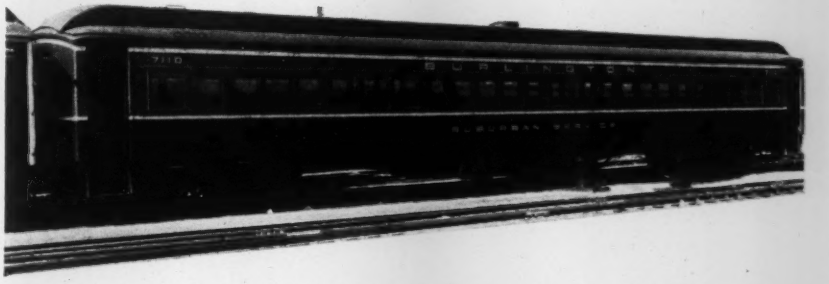
The weight of the fluid in the pipe may be ignored because, as the pipe is drained, it will spring back to its empty position, which is the condition assumed in Equation [22].

STUDY EFFECT OF HEAT ON PREGNANCY

A study to determine whether controlling room temperature will curb eclampsia, a toxic condition of pregnancy marked by convulsions and coma, has been undertaken by the University of Chicago.

A new climate room that can vary the temperature and humidity has been set up in Lying-in hospital under the direction of Dr. William J. Dieckmann, chief of staff.

The climate room also will be available for studies on heart patients and arthritis.



The Burlington is equipping 65 of its all-steel suburban coaches with cooling systems

Suburban Railroad Cars Cooled with Ice System

THE BURLINGTON railroad has underway a program calling for the air conditioning of 65 of its all-steel suburban coaches, 23 of which have already been completed. In addition, 14 main line coaches are undergoing similar improvement for use in suburban service.

The cars are being equipped with ice activated cooling systems. Both the heating system, which consists of fin radiation and overhead heating coils, and the cooling system are thermostatically controlled.

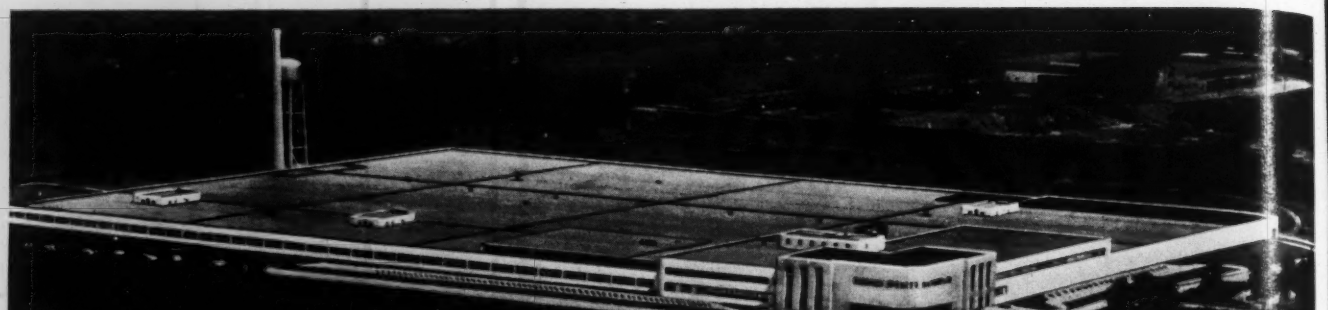
The cooling system of each car consists of two ice bunkers with a total capacity of 1800 lb, a sump, a strainer, and two motor driven water pumps, all located underneath the car. The pumps force ice water through the coils, one of which is located at each end of the car.

An overhead duct is used for air distribution. The duct is partitioned at the center of the car so that each overhead cooling or heating unit supplies conditioned air to one-half the length of the car. The exhaust is at the center of the car.

Each overhead unit is equipped with a double blower, motor driven. Outdoor and return air is filtered.

Source of power for the system is a diesel engine driven direct current generator in the end of one of the cars, one such car being used on each train. All cars of the train are coupled together with electric train lines.

There is a cooling coil at each end of the car, and the duct is partitioned at the center so that each unit serves one-half the car. Exhaust is at the center



How Big Hardware Handler Handles Its Heating and Air Conditioning

STOCKING some 30,000 different hardware items received from 3000 different manufacturers and assembling and shipping them out again to 9000 regular retail customers is the business of Hibbard, Spencer, Bartlett & Co., hardware wholesaling firm of Evanston, Ill. The new $4 million warehouse and office building houses over 600 employees, covers some 800,000 sq ft, and is designed so that the most modern materials handling techniques may be used throughout. Though the plant was built during a period of high costs, an old Chicago plant and three smaller warehouses were sold in 1946 for over $4.5 million. Then too, gross annual sales have increased from $15 to $19 million during the war to approximately $27 million last year.

The key to efficient handling of goods is in the one floor layout of the warehouse where goods are loaded on large trays called pallets which are stacked and moved by fork lift trucks. Power tractors, trailers, hand guided transporters, dragline conveyors, and belt conveyors are also used. Constant inventory control, of course, is mandatory to smooth handling and is accomplished by recording the loading and disposal of goods on 19,000 pallets.

Production Line Flow of Hardware

Incoming goods arrive at either a 15 truck depot or on three railway tracks capable of handling 45 freight cars (all within the warehouse). After palletizing, except for a few large items, goods are removed to storage and are assembled as (1) original package goods to be sold in the same packages as received, (2) open bin stock for less than package orders, and (3) heavy goods. For each order, clerks assemble cards showing the storage sections involved. One of 300 odd trucks is used for each order and its corresponding cards. The truck is pulled, at about 25 fpm, by a 1200 ft overhead, open bin drag line. Clerks on roller skates fill the order from the open bin stock. Empty cartons are sent on a 400 ft belt conveyor to the packaging department. Arriving at the packaging belt line, goods are wrapped and move by conveyor to the 1400 ft upper drag line where the original package items are filled in a similar manner. The order is then carried by the drag line to the heavy goods stores which are assembled as required. Shipment is made from a nearby 25 truck loading platform, also inside the warehouse. According to F. F. Threadgold, vice president in charge of operations, orders are generally shipped within 6 hr after arrival.

Handling Fuel Oil Is Simplified

Low pressure steam for heating the office and warehouse is generated at 4 to 7 psi in five oil fired, horizontal return tubular boilers of welded steel construction. Bunker C oil, in approximately 9000 gal lots, arrives in a tank car spotted near the boiler room. After being heated with steam, it is drawn through 3 in. flexible armored steel hose and is pumped to two 20,000 gal underground storage tanks of 5/16 in. steel. The oil transfer pump used is of the rotary type and is fitted with a suction strainer, relief valve,

HANDLING 30,000 different hardware items rapidly and efficiently requires modern techniques. The office and warehouse building of Hibbard, Spencer, Bartlett & Co., is a fine example of the proper use of up-to-date methods. Heating and air conditioning systems were designed to expedite shipments and minimize maintenance

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and pressure gage. Its capacity is 75 gpm. A heater and a 1½ in. circulating pump are used to heat the oil in the storage tanks.

Between the storage tanks and the oil burners the fuel handling system consists essentially of two fuel oil pumps, each of 9 gpm capacity, and two straight tube type, steam operated heaters. These are used to heat the oil to 160 to 170 F. One pump and one heater are for standby. A 7½ kw heater is used for starting purposes.

The five boilers, rated 250 hp each and equipped with rotary type burners, operate in series. After one boiler has reached its capacity, another cuts in, etc. As the demand is reduced, the units shut off one-by-one until the load can be handled by the least number. Oil valves of the automatic burners are linked with primary and secondary air dampers so as to permit swinging the burners open without disconnecting the linkage. The capacity of each burner is sufficient to develop 500 hp. Burner controls include an aquastat to prevent starting until hot oil is received from the electric heater, a dual electric-gas ignition system, an electrode to keep the burner from starting until the gas pilot is burning, a photoelectric flame failure switch, an alarm arranged to ring in case of flame failure or low water, a latch switch to cut off oil when the burner is swung away from the boiler, a pushbutton to recycle controls after flame failure, a viscosity compensating oil control valve, and a control to cut off the oil supply in case of insufficient fan pressure. A disconnect switch, low water cutoff, and automatic water feeder are, of course, provided for each boiler.

Outdoor thermostatic controls are used to anticipate sudden outdoor temperature changes and to provide stepping up of boiler output.

Each burner is equipped with an intermediate modulating control system to give selective high fire, low fire, and automatic operation. This system moves the air door to a nearly closed position each time the burner stops, starts the burner from a low fire gradually increasing both fuel and air, and while the burner is in operation, varies the flame in accordance with steam pressure. The modulating motor is interlocked so that the burner cannot start except from a low fire position.

An electrically operated, overfire draft control system is furnished on each boiler. An uptake damper is opened before the burner can start, is used to maintain a variable draft in accordance with burner demands, and is closed when the burner stops. Instruments on the boiler room control panel include combustion recorders indicating percent CO_2 and flue gas temperatures, photoelectric smoke density meters, a smoke recorder, and draft gages.

Two boiler feed pumps of the horizontal split, centrifugal type are installed, and each has a capacity of 75 gpm at 25 psi discharge pressure. A pressure of 20 psi is maintained in the boiler feed line and the receiving tank is of 560 gal capacity.

In the groundfloor warehousing and shipping areas there are 97 unit heaters with a total rated capacity of approximately 112,000 sq ft EDR. Both horizontal and vertical types are used and individual capacities range from 58,800 to 482,400 Btu per hr. Some of the heated areas are 1200 ft from the boilers. Seven vacuum pumps, four installed 9 ft above the floor and three in floorpits, have ratings ranging from 5000 to 65,000 sq ft of radiation.

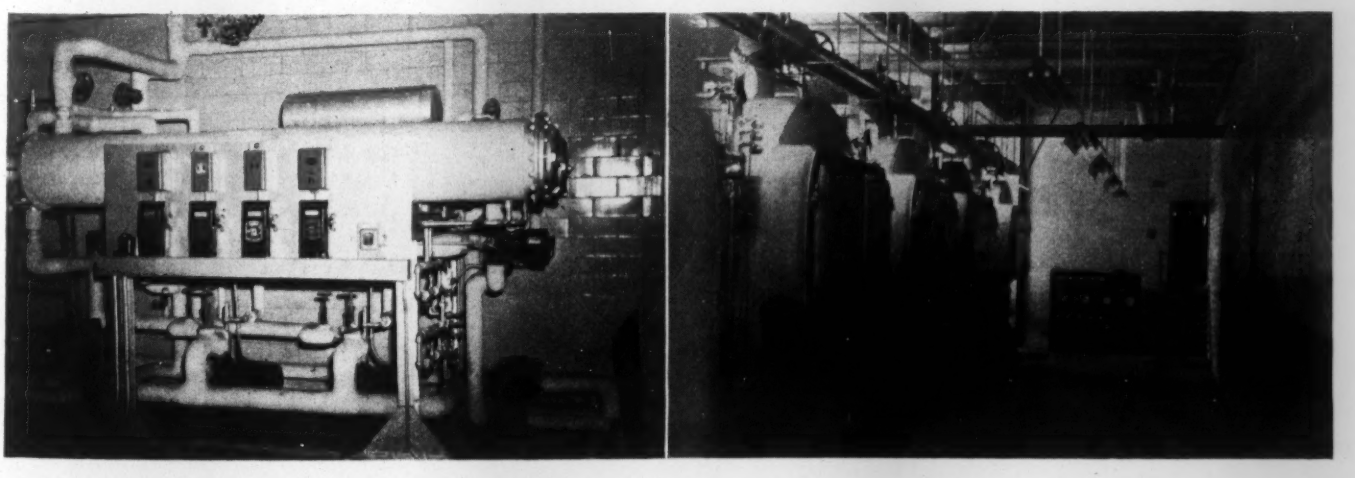
Forty-eight inch expansion loops are used in the piping system. Allowance for expansion is 2 in. per 100 ft for temperatures of 70 to 218 F.

Offices Conditioned for Year 'Round Comfort

The two general offices occupying about 60,000 sq ft of floor area, an auditorium designed to seat 700 persons, the retail sales store covering 10,000 sq ft, a cafeteria of about 9000 sq ft floor area, a 35 ft high lobby, the engineer's office, personnel office, first aid rooms, two private offices, a director's room, and a conference room are conditioned for year 'round comfort.

Water used for conditioning is chilled from approximately 50 deg to 40 deg in a flooded type chiller connected to a 350 hp centrifugal compressor unit driven by a synchronous motor. The average refrigerant temperature in the chiller is 35 deg and the compressor is provided with automatic modulation from full load down to approximately 50 percent full load. Refrigerant suction line piping was designed for a pressure drop of 1 lb. The condenser is of the shell and tube type and is mounted on steel floor supports. Vibration

***Left*—Straight tube type steam heaters are installed for preheating fuel oil. *Right*—Horizontal return tubular boilers are equipped with rotary oil burners**



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eliminators of cork are used for the compressor unit which is mounted on its own separate concrete foundation. The spray type cooling tower is constructed of steel and redwood and is mounted on the roof. It was selected on the basis of cooling 1050 gpm from 100 F to 90 F with an outside wet bulb temperature of 76 F and with a maximum drift of 5 percent. The tower tank is provided with an overflow and makeup water is controlled by a float valve. The chilled water pump is rated at 883 gpm against a 100 ft head. It is a 5 in. horizontal split shell, double suction centrifugal unit driven by a 30 hp motor. A duplicate unit is used for standby service. The cooling tower water pump and its identical standby unit are of the same type as the chilled water pumps but are driven by 50 hp motors and are used to circulate 1050 gpm at 130 ft head.

There are four main air conditioning systems; two of the conventional pull-through, zoned booster type for the general offices, a 100 percent outside air system for the auditorium, and a hot-cold deck zoned type system for the retail store and other miscellaneous rooms. Separate zoning is used for interior and exterior bays. Equipment for each system, located in the fan room above the general offices, includes an automatic, oil bath type air filter, heating and cooling coils, a spray washer humidifier, and a centrifugal fan.

The general office systems are provided with static pressure regulators which actuate the outside air dampers to assure constant minimum outside air being supplied. In addition, an outside air thermostat actuates separate standby two-position ventilation air dampers whenever the outside air exceeds 54 deg and the cooling cycle is not in operation. The control of all heating, cooling, humidifying, and dehumidifying is from thermostats and humidistats located in the return air streams. To prevent lowering the effective temperatures, two-speed fan motors are used so that when the dry bulb temperature is lowered to about 75 F, the operating speed is reduced from 1200 to 900 rpm. Bypasses around cooling coils are set at a minimum closed position, and humidity controls will then open from this point while retarding face dampers on a reversible, modulating basis. Should the humidistats become entirely satisfied, and thermostats require additional dry bulb cooling, they reopen face dampers to a maximum of 60 percent of total air, and should this reduce the dry bulb temperature to 75 deg, fan motor speeds are automatically reduced. All controls for the general office systems are of the summer-winter type. Steam flow to all nonfreeze, standard, and booster coils is under control of thermostats actuating reversible, modulating motorized steam valves.

For the introduction of air, the general offices are divided into four zones, two of them near outside exposures. Air is discharged from 306 panel type diffusers located behind the suspended metal acoustical ceiling. In the offices, the perforated metal tile without acoustical pads takes the place of the diffusion plate normally used with this type diffuser. Alternate rows are used for supply, return, and exhaust. This arrangement is unique in that return and exhaust air enter the plenum through perforated ceiling diffusers. There has been no indication of short circuiting and a distinctive advantage is said to be the use of a large area for the exhaust and return air, so that high velocities are not built up around these sections. This arrangement is also designed to pick up a large part of the heat gain from lights and roofs. Some air is exhausted through the lavatories and other spaces. All zones have separate cooling and heating coils which are controlled by indoor thermostats. Throughout the offices finned pipe radiation is installed on the outside walls above baseboards with each zoned exposure being under control of an outdoor thermostat exposed to wind, sun, and temperature. Office windows are of the double glass type.

In the auditorium, zoned direct radiation is provided for heating when the room is not in use. Exhaust fans are manually operated and a summer reheat coil is used with the conditioning system for this room and also for the cafeteria system. A gas boiler of 3000 sq ft EDR rating is used.

The retail store has approximately 1000 sq ft of single glass used for show windows. The hot-cold deck system is divided into three zones and thermostats in each actuate modulating dampers in each deck take-off. A precooling coil in the outside air stream is used for summer dehumidification to prevent bypassing a mixture containing excessive moisture. Conditioned air is introduced through 68 perforated panel diffusers and then passes from the store through grilles to the adjacent cafeteria where additional conditioned air is added through perforated ceiling diffusers. This additional air is taken from the west zone of the system supplying the general offices, but ahead of main outlets on that system. As previously noted, a reheat coil is provided for the cafeteria system. A cold water dehumidification coil, for winter use, is also provided

In the general offices conditioned air is discharged from 306 panel type diffusers located behind the suspended metal acoustical ceiling

ahead of the reheat coil. The kitchen exhaust system, which incorporates a range hood fitted with grease filters, provides air removal for the cafeteria. It and the conditioned supply air for the cafeteria are under automatic control, an increase in load increasing the flow of air.

Extensive Sprinkler System Used

An extensive sprinkler system of the wet and dry type is used throughout the building. Water, taken from city mains, is pumped to a 100,000 gal storage tank located 100 ft above the ground. The tank, of course, is fitted with steam coils to prevent freezing and incorporates a float control. In the truck loading zones and other areas where freezing might occur, sprinkler piping is charged with air.

Scattered throughout the building are 31 fire alarm boxes of the manual break glass type. All sprinkler valves are supervised and water flow in the system is not only indicated on the main plant protection annunciator (located in the engineer's office), but in addition, the auto call bells give the alarm indicating the exact section where flow occurs. A high and low storage tank alarm is also located in the engineer's office.

Sprinkler piping is located in the plenum above the general office. A thermostat in the plenum is used to actuate an alarm (in the plant engineer's office) in the event the plenum temperature falls below 40 F.

City water is available at approximately 40 psi. Because of possible variations in city pressure and because greater flexibility in operation is possible if higher pressures can be made available, domestic water is stored in a 1000 gal, air cushioned tank, at about 45 psi. A centrifugal pump, with an identical standby unit, is used to supply the tank. If necessary, a higher storage pressure can be maintained.

Some 13,000 ft of copper tubing is used in the lawn sprinkler system. Sizes range from 2 in. for the supply mains down to ½ in. Piping is installed about 18 in. below ground level and is pitched toward a number of drainage pits.

It seems only natural that in a plant utilizing the most modern material handling techniques heating, ventilating, air conditioning, and other mechanical equipment would be of the latest design and that automatic controls would be used extensively. This, of course is the case, but according to George Fredericksen, plant engineer and superintendent of maintenance, a system of regular cleaning, lubrication, inspection, etc. is important if the hardware is to be kept moving. Under him are two assistant engineers, one fireman, two electricians, two handy men, one carpenter, one painter, one gardener, six janitors, a fork truck serviceman, and a matron. In addition to all regular cleaning, painting, and repairing in and around the building, this group takes care of all regular maintenance and repair of mechanical equipment.

Preventive Maintenance Keeps Hardware Moving

Boilers are shut down at night except in cold weather, and to date, no trouble has been experienced in raising temperatures in the morning. The operation of oil burners and boiler specialties is checked daily and the atomizers are cleaned every other day. Boilers are given an inspection every month and flues are cleaned every two to three months. The unit heaters, which are used to maintain the warehouse at 60 to 65 F require little attention as bearings are of the sealed type. In general, traps and strainers are checked once a month and pumps are given a monthly inspection and are lubricated every two to three months. All plant protection equipment including pumps, valves, the position of valves, and the air charge in dry sprinkler piping is checked weekly.

In regard to air conditioning equipment, the 350 hp compressor unit is checked daily and frequently oftener. Oil levels, pressures, and temperatures are noted. Mr. Fredericksen is particularly interested in variations from week to week. Inasmuch as compressor capacity is automatically varied by throttling the suction so as to maintain a constant chilled water temperature which may be preset, the chilled water temperature is maintained as high as possible (but not exceeding 40 to 45 F required for the auditorium and cafeteria systems) so that the compressor will tend to be in continuous operation. Cooling tower spray nozzles are inspected weekly and the water level and operation of the float control are checked at the same time. To date no water treatment has been used in connection with the cooling tower which utilizes Lake Michigan water. Humidifier sprays are also inspected weekly. Fans have sealed bearings and fan motors are greased every two months. Sludge is removed from the oil sumps of the automatic air filters every two to three months. Kitchen range grease filters are cleaned every two months by washing with steam or hot water.

To get around the warehouse in a hurry, maintenance men use bicycles

Motor Scooter, Bicycles Aid Servicing

As can be seen from the foregoing, maintenance men are constantly working in one section of the 800,000 sq ft plant or another, and a good deal of back and forth traveling is inevitable. Over a period of months this would add up to a considerable amount of lost time if it were not for the fact that mechanization has been extended to this department. Mr. Fredericksen travels about on a motor scooter and his assistants use bicycles.

During the 1948-49 heating season the total fuel oil consumption was 226,000 gal. Data on air conditioning costs are not available at this time as the company is working with the electric utility on an analysis of plant power consumption and demand to determine the most favorable rate.

Engineering Systems were the architects and engineers, Mel J. Stevenson, the consulting mechanical engineer, and O. A. Wendt Co. was the heating and ventilating contractor. All are Chicago firms.

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QUESTION OF THE MONTH

YOU ARE invited to submit a heating, piping, or air conditioning question for publication here. You are also invited to submit answers to previously-published questions from others. Write the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

Practical Pointers on Installing Radiant Heating and on Re-Using Water from Air Conditioning Coils

Two questions are answered this month . . . one is about the proper installation of copper tube in ceilings for radiant heating, and the other on factory use of water from air conditioning coils. . . . The new question (which you are invited to answer) refers to drainage of condensate from ventilation heaters

INSTALLING radiant heating coils was the question asked in the August issue by "W.F.," a foreign subscriber. He wrote as follows:

"We are accustomed in this country to install panel heating installations with copper tubes where the copper tubes are in the ceilings and particularly in the lower part of the concrete slabs. The general procedure in the erection of this type of installation is that after the molding for the slabs has been finished, the reinforcement steel bars are laid and immediately on top of the bars we install copper tube coils for which we are using generally pipes of ½ or ¾ in. interior diameter. We never had any trouble at all in this kind of installation but one of our competitors having the contract for a new office building received instructions not to lay the pipes inside of the concrete, but to have them suspended underneath the slab and covered with plaster.

"Is there any new experience on this problem which might have induced the owner of this building to give these instructions and if there are defects in the method which we have been using, please advise."

Here are some comments on this matter:

"IN REPLY TO 'W.F.,' the installation of copper tubes in concrete slabs is common practice and has proved to be entirely satisfactory. Tubes buried directly in the slab usually provide the most economical construction. Thousands of successful installations testify to the soundness of the panels.

"The use of the complicated construction described by 'W.F.' is probably based on an erroneous conception of the effect of embedding copper tube in concrete. Under usual conditions, the forces caused by thermal expansion are less with copper tube than with other materials even though superficial examination of the characteristics of the materials would indicate otherwise.

"There appears to be no reason why 'W.F.'s' present design of panel, with tubes embedded directly in the concrete, should be altered."—R.L.M.

"REPLYING TO 'W.F.,' it would have been very helpful if he had furnished a sketch or sketches indicating the conditions in question. Apparently, he is chiefly concerned with a structural concrete floor slab; that is, one that is used between two floors of a building rather than a concrete floor slab on the ground.

"The great objection to embedding a radiant heating coil in a concrete slab is the tremendous heat storage capacity of the slab. This would normally result in time lags both during the heating-up period and the cooling-off period and would involve complicated con-

trols which might not ever prove to be completely satisfactory—especially if large solar heat gains might occur during the heating season.

"I would suggest that a layer of effective insulating material be installed on the underside of the structural floor slab. The heating coil could then be installed immediately below this insulation and expanded metal lath could be installed below and in good contact with the heating coils.

"Plastering could then be done on the expanded metal lath just as it would be done on any plastered surface using the same plastering technique. A sufficient amount of penetration of the plaster would take place through the metal lath to embed the copper tube sufficiently to produce satisfactory heat transfer to the radiating surface of the completed heating panel. The accompanying photograph gives a fairly good idea of this, although it was taken in the attic space in a building of frame construction.

"In an installation of this kind, I can see no good reason for using copper tube larger than ⅜ in. nominal diameter, known as copper water tube which is actually ½ in. OD.

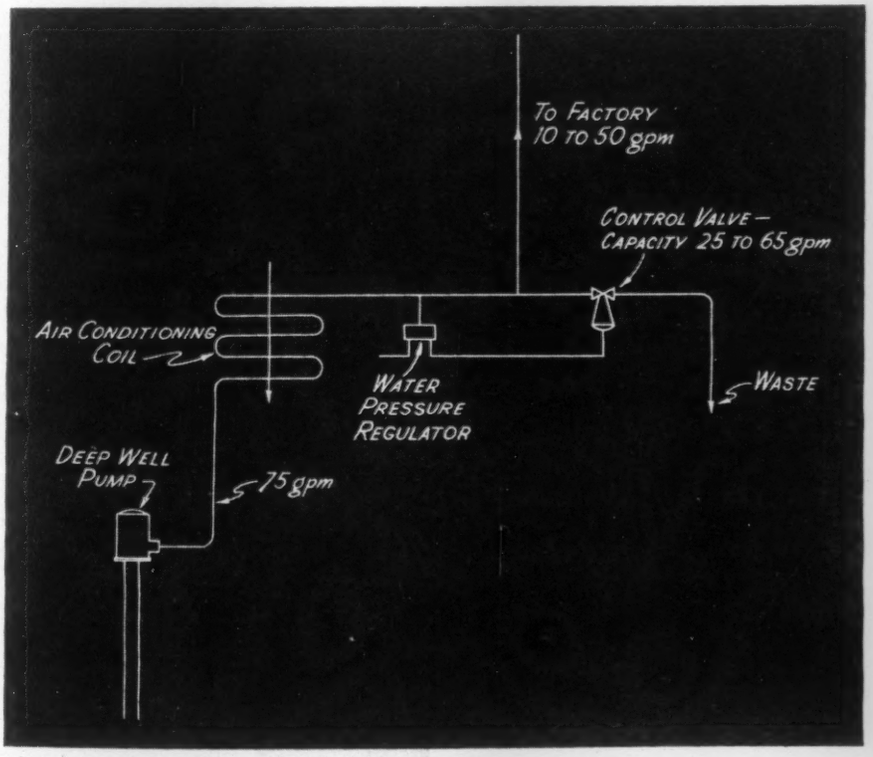
"From the standpoint of heat output, pipe or tube size in a range of ⅜ to ¾ in. nominal for a radiant heating coil located in a plaster ceiling, is relatively unimportant. The pipe or tube size, however, does affect the load on the circulator; consequently, the length of ⅜ in. copper tube in a single coil should preferably be between 120 and 140 ft depending on whether a low head or high head circulator is used.

Penetration of the plaster through the metal lath embeds the copper tube sufficiently to produce satisfactory heat transfer, "D.L.M." points out

"In noting the reference by 'W.F.' to suspending the heating coils underneath the slab and covering them with concrete, I wish to point out the fact that investigations and experience have shown that if the heating coils are completely embedded in plaster with metal lath or some other plaster base immediately above the coils, streaked ceilings are very apt to occur. This is due to the fact that in such an installation, there would be a comparatively thin layer of plaster between the tube surface and the finished plaster surface and there would be a mass of plaster several times that thickness in the space between the rows of tubes in the heating coil. A condition of this kind would also produce uneven surface temperatures on the plastered ceiling.

"In most cases, it has been found that tube spacing of 6 in. on centers of the rows will give satisfactory results without requiring too high water temperature through the coils."—D.L.M.

The valve shown here will bleed out the difference between the water supplied by the deep well pump and the amount used for the factory, says "J.H.E."



Re-Using Water From Cooling Coils

"Water furnished by a deep well pump supplies 75 gpm to a set of coils for air conditioning a factory area," said "G.M." in a question published in the September HPAC. "The plant engineer wants to use the water after it leaves the coils. However, the factory demand for water fluctuates anywhere from 10 to 50 gpm. Using the present setup,

what is the best way to obtain constant pressure for plant use, constant pressure for the air conditioning coils, and adequate excess water disposal?" he asked.

"IN ANSWER to 'G.M.'s' question, the accompanying sketch shows a recommended method of controlling the pressure of the water to be furnished for factory use. The valve will bleed out the difference between the water supplied by the deep well pump and that used for the factory."—J.H.E.

Vacuum Breaker Between Ventilation Heater, Trap?

You are invited to answer the following question from a reader of HPAC. Suitable comment on the matter will be welcomed, and—space permitting—will be published and paid for at regular rates. Sketches and photos are particularly desired. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

"We have experienced some difficulty with ventilation heaters because of water hammer and possible freezing due to inability to get proper drainage from the heating coils because of the vacuum existing at low loads. It has been recommended to us that a tee, a short line to atmosphere, and a check valve be provided between the heater drain and the steam trap to act as a vacuum breaker to prevent the water from being held in the heater.

"What comments do readers of HPAC have on this system with respect to heating and control? Has any corrosion been experienced, where the source of low pressure steam was from a high pressure boiler, because of the possibility of air being dissolved in the condensate due to the use of a vacuum breaker?"

Sewaren Generating Station Uses 1500 Psi, 1050 F Steam

UPON completion of four units, Sewaren generating station, Sewaren, N. J., will have an installed capacity of approximately 450,000 kw and will be the largest of the five major generating stations which serve the Public Service Electric and Gas Co. electric system.

The basic objective in the design of the station was to take advantage of every technical advance in the art that was judged to be practicable and dependable in operation. Efficient operation is assured by throttle steam conditions of 1500 psi and 1050 F, eight stages of feedwater heating in all units, and reheating to 1000 F in the fourth unit. The simple, straightforward arrangement of the plant, which was accomplished in large measure by unit design, contributed to its relatively low first cost. One boiler serves one turbine-generator without cross connection to other units. Operating simplicity is achieved by central control of the units in pairs, shaft-end auxiliary generators, and all-electric auxiliary drives. Building volume and cost are reduced by semi-outdoor type boilers. Building maintenance costs are decreased by extensive use of tile for interior finish, ventilation under slight air pressure for cleanliness, and by the simple architecture.

Wide Use of Welded Joints

The piping systems of the plant are made up with the widest practicable use of welded joints. The only flanged joints exposed to 1050 F steam are those in the steam admission pipes from the turbine control valves to the top half of the high pressure turbine casing. In the high pressure boiler feed piping there are no flanged line joints. Valve bonnets in this system are of breech lock, seal welded bonnet design without a bolted closure. In the larger sizes, the piping systems carrying salt water are of cement lined steel, with welded joints. The 48 in. circulating water pipes are reinforced concrete construction.

There are no valves between the boiler and the turbine stop valves in the main steam system. The pipe is made of 3 percent chromium —1 percent molybdenum alloy steel. The main run is 16½ in. in outside diameter, forged and bored to 2¾ in. wall thickness. The turbine stop valves are made of stainless steel which expands about 50 percent more than the ferritic steel of the pipe. The welded joint between the two was made in the shop by a new method, the purpose of which is to have the major portion of the interface between dissimilar metals longitudinal to the pipe rather than transverse, and therefore subject principally to shear stress as a result of internal pressure or bending forces.

The piping and valving of the feedwater system have been simplified by locating the heaters in pairs, placing more heaters on the suction side of the boiler feed pump, and locating three of the low pressure heaters in the condenser neck.

Ventilation and Heating

Each unit has its own ventilating system which automatically controls the air temperature in the various parts of the main building. Filtered air is distributed to different locations and elevations in accordance with the heat losses at these points. One unit has an air washer which provides evaporative cooling when the proper relative humidity conditions prevail. All three systems are arranged for partial recirculation and have heating coils to warm the air in cold weather. The service building is ventilated by a daytime system and a 24 hr system. Both of these use 100 percent outdoor air which is warmed by steam coils in cold weather. The systems are designed to operate with all windows closed and to maintain a slight positive pressure to keep dust and dirt out of the buildings.

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SAM LEWIS' PAGE

Informal comment on heating, piping, and air conditioning matters is given in this regular feature by Samuel R. Lewis, consulting mechanical engineer, member HPAC's board of consulting and contributing editors

Several requests for comment on various questions have been received by Mr. Lewis from readers of his page. He devotes his space this month to some of them. . . .

THE WRITER of a regular page such as this one gets a number of questions from his readers each month. These are always welcome, but sometimes I suspect that the editors forward me requests that they can't answer themselves!

And sometimes I think they dream up questions just to see if I have any answers!

Be that as it may, it seems advisable again to devote my page to clearing up some of this unfinished question business.

Disappearing Refrigerant Level

One of the readers of this page says that a 75 hp "Freon" condensing unit is used for air conditioning at his plant. There are six direct expansion evaporator coils in series, each having a thermostatic expansion valve. The "Freon" liquid going to three of the coils may be throttled by an electric operated valve for temperature control purposes.

There is a bullseye sight glass in the vertical liquid pipe about 4 ft above the bottom of the receiver. There is 3 ft additional of vertical liquid pipe above the sight glass prior to expansion or other valves.

He asks why the liquid level drops below the sight glass when the compressor is shut down for some time.

The obvious thought back of this question is that the liquid receiver will be at a very substantial pressure above atmospheric and the vertical liquid pipe rising up 4 ft above the receiver would be at the same pressure, less only the inconsequential pressure drop due to 4 ft of static head. Therefore, what is the explanation for disappearance of liquid from the sight glass?

One plausible explanation is that the ambient air around the liquid piping may be warm, and that part of the relatively small amount of liquid in the vertical pipe expands to a gas during a long shutdown. Gas is lighter than liquid, and the liquid, seeking balance, settles back into the receiver.

He says also that there are several other condensing units similar to the 75 hp one described above, and asks why the sight glass in one of these other units never indicates assured liquid when the plant is in operation.

This question is not so easy to answer, but it is probable that the liquid refrigerant riser pipe in this particular machine is smaller, in relation to the evaporators, or to the expansion valves, than the same liquid pipe in the unit first described. A too small solenoid valve might throttle the liquid flow to such an extent that evaporation occurs in the liquid pipe prior to the solenoid valve, thus creating the impression of insufficient liquid flowing through the sight glass.

He also asks if it is natural for the liquid level to drop below the sight glass during a long shutdown. The answer is that it is natural in a plant arranged as described. This is not a criticism of the plant.

How Construct a Steam Bath?

A friend in Florida wishes some advice about construction of a cubicle for taking a steam bath. His idea is a sort of cabinet 4 ft square in plan and 6 ft, 6 in. high. He suggests ordinary wood studding walls lined with sheet metal.

He does not say from what source the steam will come, but evidently no great volume will be required for so small a room. Based on steam room experiences in public bathhouses and in athletic clubs, the prime consideration is that the walls and floor and ceiling be so well insulated that surrounding rooms will not be overheated, and

so that the steam room be so warm on the steam side that condensation will not occur at an excessive rate. There is no particular objection to a structure braced with wood studs above wood joists and below wood rafters.

I would consider lining the studs, joists, and rafters with ⅞ in. tongue and grooved material, then lining this with 1 in. thick board type commercial insulation. Then, I'd line this with a waterproof material such as sheet copper, galvanized steel, or with one of the stainless alloys. The joints must all be soldered or welded or brazed, or otherwise made permanently watertight.

There should be a trapped drain from the floor to care for the condensate and to drain away the sweat that the victim must lose.

The door should have metal weatherstrips if the construction is to be even approximately permanent. The resistance to heat transmission really should be greater than the 0.4 Btu which was suggested by the inquirer.

The steam supply pipe should have a valve inside the cubicle, easily operable by the victim, and there should be a separate valve outside so that he could be rescued if necessary, by a friend.

The early inhabitants of Florida used to build a small wigwam or hut of twigs, often plastered on the outside with mud so as to encourage vapor-tightness. They built a big fire in the open air, and therein heated a pile of stones. The warm stones then were conveyed into the hut and when water was sprinkled on them a change of state from water to steam ensued. Such a hot steam bath was said to have cured almost anything.

A Question on Garage Ventilation

An automobile is sufficiently mobile so that the car runs away from the odorous and dangerous and unclean products of combustion discharged through the exhaust pipe. However, it is necessary on many occasions, when adjusting the engine, as inside a workroom, for the car to stay close to the men who work on it. These products of combustion from the engine may permeate the atmosphere around the men.

Automobile engine test blocks usually have nearby adjustable flexible metallic exhaust pipes that can be connected to the outlet from the engine that is being tested, but under such circumstances the engine must work against resistance or back pressure induced by the ducts and this pressure may be in excess of the back pressure that exists when the car is moving. For similar reasons, while an exhaust fan could induce a strong suction on the engine exhaust pipe, such reduced back pressure might interfere with a true record of the engine's performance.

A reader states that when the conventional flexible exhaust connection is made to an engine that is running under observation in a workroom, so great is the back pressure that objectionable gases escape through various small openings in the exhaust manifold, muffler and other connections in or under the car. He requests suggestions as to some acceptable scheme for protecting the automobile mechanics from gas poisoning. He suggests a pan or inverted hood under the automobile, with a duct leading to an exhaust fan.

While carbon monoxide at high concentrations in air probably is heavier than air at the same temperature, so that the objectionable components, if not agitated, might settle down close to the floor, there is no chance of such definite separation around an operating engine because the exhaust gases are warmer and thus lighter in weight than the surrounding air. For this reason an "inverted hood" would not have much chance of success. In general, upward flow has been found preferable to downward air flow in garage ventilation.

The exact location of the leakage of carbon monoxide through the car pipes probably is different with every engine and car. Any reversed hood scheme thus would have to be larger than the area of the car, and to be effective it appears that a relatively enormous volume of air would have to be moved. Such a draft would be objectionable to the mechanics unless the air temperature was controlled, as by heating in winter. Any hood over which the car must be driven would require exceedingly sturdy construction and would have to be cleaned very frequently. The cost of construction and maintenance and of heating the air and of running the fan for such a scheme seems out of proportion to the probable improvement that could be obtained.

It does seem that it should be possible to apply suction in the duct that connects to the engine exhaust pipe, to such an extent that subatmospheric pressure would be maintained on the exhaust system all the way back to the exhaust ports of the engine block. An exhaust fan capable of maintaining, say, an inch of water could exert a constant pressure on this duct. A simple and inexpensive pressure gage could be connected into the exhaust duct on the fan side of an adjustable valve in that duct.

Then:

1) An engine is to be adjusted.

2) The flexible temporary pipe is to be connected.

3) The exhaust fan is to be started and the engine is speeded up to the desired limit.

4) The pressure gage indication is noted and the valve in the duct is to be opened or closed until no leakage of gases at the joints in the system of the car is observed.

This scheme of course might be objectionable, unless the pressure is readjusted for engine speeds slower than the maximum or for unusual mixtures of exhaust gas.

It would be possible to provide automatic readjustment of the valve in the exhaust duct so that regardless of the volume or pressure of the products of combustion leaving the engine, the suction on the exhaust duct would remain constant. Such a device would be rather expensive and impractical for the ordinary service garage.

Experience over many years in cities has developed a ventilation code for working areas in garages that serve internal combustion engines. This requirement is that not less than 3 cfm of air taken from outdoors and adequately warmed shall be provided for each square foot of floor area in the working space.

An idling gasoline engine has been found to discharge enough carbon monoxide to contaminate approximately 6000 cfm of air flowing around the car, on the basis of one part of carbon monoxide in 10,000 parts of air.

* * * *

Next question, please!

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Heating, Piping & Air Conditioning

AMERICAN SOCIETY of HEATING and VENTILATING ENGINEERS

Journal Section

Effect of Panel Location on Skin and Clothing Surface Temperature

By L. P. Herrington* and R. J. Lorenzi**, New Haven, Conn.

SUMMARY—Since room comfort is closely related to the surface temperature of an occupant's skin and clothing, the authors conducted experiments recording these variables under comparable conditions. The purpose was to find what effect the location of the radiant heating panel had on the human body. The authors conducted tests for five days each on the effect of floor heating conditions and ceiling heating conditions. Measurements were made of the effect of various temperatures of floor surface, room center and ceiling surface on subjects, as indicated by head temperatures (an average of cheek, upper hair surface, and dorsal neck area) and mean exposed skin temperatures and clothing surface temperatures. Then, mean comfort votes and mean temperature votes were taken.

One of the primary conditions of thermal comfort is a skin temperature ranging from approximately 80 F on the toes and sole of the foot to approximately 95 F on the trunk and certain facial areas, with an overall average for the skin surface of 90-92 F.

The authors believe it is necessary to avoid local heating effects which may induce low vascular tone in the foot and leg. Therefore a ceiling panel is preferred to floor panel, since the authors state that floor temperatures above 75 F are not desirable.

In the past few years low temperature radiant heating panels have seen increasing use in this country. A number of publications have considered the problem of the most advantageous location of such panels, with emphasis on installation and constructional features.[1,2] Recent studies at this laboratory of the performance of electrically heated panel systems have directed our attention to the comfort aspects of this problem. It seems probable that under certain conditions of room geometry, installation procedure, and heating load, panels installed in ceiling, floor, or side walls may give satisfactory heating results. However, under average conditions of installation, the various locations may have substantially different possibilities for discomfort.

The primary difference in the effect upon the occupant of different panel locations would appear to be a directional heating effect. This effect should show itself in variations in the regional surface temperatures of the skin and clothing of the occupants. Floor panels may overheat the lower segment of the body, ceiling panels may produce overheating of the head, and side panels could conceivably produce unilateral, and undesirable, differences in occupant surface temperature. Since comfort and occupant surface temperatures are closely related, experiments recording these variables under comparable conditions with floor and ceiling panel locations have been conducted.

Experimental Test Room

The experimental work was conducted in the climatic test rooms of the Pierce Laboratory of Hygiene, whose construction has been described elsewhere.[3] In brief resumé, these consist of two rooms 15 ft by 12 ft by 8 ft high, separated by an instrument corridor 4 ft wide. Three windows opening on the climate controlled shell spaces pro-

*Director of Research, John B. Pierce Foundation, Laboratory of Hygiene.

**Research Engineer, John B. Pierce Foundation, Laboratory of Hygiene. Member of ASHVE.

[1]Exponent numerals refer to References.

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vide, in conjunction with painted plaster walls, oak floors, and side bracket lighting, the appearance of a small living room. The entire wood framed structure is enclosed within a larger climate conditioned shell space, so divided as to permit separate temperature and humidity control over a wide range in the space adjacent to each of the 6 sides of the building cube. The value of U, the coefficient of heat transmission for the wall structure was 0.25 Btu per (hour) (sq ft) (F deg).

Test room No. 1, used for these studies, was furnished with four comfortable but unupholstered arm chairs. Two of these were placed centrally against the inner wall and faced tables used by the observers. Two chairs used for subjects were placed so that each was at the center of a rectangle 12 x 7.5 ft, representing one half of the floor space. A low side table was placed near each chair on the inner wall side for reading matter and record forms.

Temperatures of floor and ceiling surfaces were obtained from recorders showing the average voltage of six thermocouples on each surface. Air temperatures were recorded at room center by a shielded thermocouple. Mean black body temperature at room center was obtained from a thermocouple placed in the center of a blackened globe thermometer, and this room center black body temperature was the temperature held constant in the experiments with different panel locations. Skin and clothing surface temperatures were measured by a multiple junction thermopile of the Hardy type.

Since the problem under test was the directional effect of a stable equilibrium room surface temperature on occupant surface temperature, it was possible to use the basic equipment of the climatic unit to produce normally heated floors or ceilings. The shell spaces adjacent to five of the six surfaces of the test room could be maintained individually at any temperature between 0 F and 120 F. Hence, by operating the side spaces at outdoor temperatures, and either the ceiling or floor shell space at an elevated temperature, floor or ceiling panel heat could be provided.

Observational Plan

Two young men were used as subjects. They were clothed in light underwear, shirt and tie, light socks, shoes, and a suit of moderate weight without vest. Ten days of observation divided into two periods of five days with ceiling heating, and five days with floor heating were scheduled. In all experiments the primary condition of comparability was the 36 in. globe thermometer at room center.[4] Conditions were controlled so that this reading of combined radiant and air temperature effects was very near 75 F for all experiments. Shell spaces representing outside climate were set at 35 F. Under these conditions the standard globe thermometer control temperature of 75 F was obtained, with floor surface temperatures ranging from 78 to 80 F, and with ceiling temperatures ranging from 94 to 95 F.

Subjects entered the test room between 1 and 2 p.m. after 30 min of quiet reading in the main laboratory. They were seated in the centrally positioned chairs, and remained there for a two-hour period. Reading, smoking, and talking were permitted. The following data were collected for each two-hour period.

a. 36 in. room center black globe temperature (mean air-radiant temperature—to be standard at 75 F globe reading)

b. 36 in. room center, air temperature

c. Mean floor surface temperature

d. Mean ceiling surface temperature

e. Average surface temperature of the lower extremities. Thermopile readings at 4 points on clothing and shoe surface between thigh level and foot level

f. Average head surface temperature. Thermopile readings at three points: cheek, upper hair surface, and dorsal neck surface

g. Mean exposed skin and clothing surface temperature. Composed of (*e*), (*f*), plus one thermopile reading of hand temperature, two readings on sleeve surface, and four readings divided between front and back areas of the trunk. Mean skin temperature readings determined by weighting the foregoing values for relative area (head, 7 percent; upper extremities, 21 percent; trunk, 31 percent; and lower extremities, 41 percent)

h. Mean comfort vote, obtained by subject vote after one and two hours of quiet, normally clothed exposure to the heating condition, and recorded on the following scale:

VOTE
1. Uncomfortably cold
2. Comfortably cool
3. Comfortable
4. Comfortably warm
5. Uncomfortably hot

i. Mean temperature vote. Subject appreciation of the terms *comfort* and *temperature* are not always identical. At the end of 45 min and 90 min, in the two hour exposure, subjects voted on a 3-point scale:

VOTE
1. Cool
2. Indifferent
3. Warm

Results

In Table 1 the mean values for five days of observation on the significant room temperatures, subject surface temperatures, and comfort

Table 1—Mean Values for Environmental Temperatures, Subject Surface Temperatures, and Comfort Votes in East Test Room Using Uniformly Heated Floor, F
(Mean Ceiling Temperature, All Tests, 70.0 ± 0.5 deg)

Test No.	Black Body Temp. Room Center	36 In. Air Temp.	Mean Floor Temp.	Lower Extremities Temp.	Head Temp.	Mean Exposed Skin & Cloth. Temp.	Mean Comfort Vote	Mean Temperature Vote
1	75.4	75.0	79.6	85.7	91.2	85.6	4.0	3.7
2	75.0	74.3	77.9	84.1	90.2	84.3	4.0	2.0
3	74.3	73.5	78.2	83.4	89.8	83.4	3.3	2.3
4	75.0	74.0	78.5	84.5	90.2	84.8	3.3	2.3
5	75.1	74.5	78.5	84.9	90.3	85.0	3.2	2.7
Mean Value	74.96	74.26	78.54	84.52	90.34	84.62	3.56	2.60

Table 2—Data Comparable to Table 1 for Uniformly Heated Ceiling, F
(Mean Floor Temperature, All Tests, 72.8 ± 0.5 deg)

Test No.	Black Body Temp. Room Center	36 In. Air Temp.	Mean Ceiling Temp.	Lower Extremities Temp.	Head Temp.	Mean Exposed Skin & Cloth. Temp.	Mean Comfort Vote	Mean Temperature Vote
11	75.8	73.4	95.1	82.3	89.8	83.7	2.7	2.0
12	75.1	74.3	95.7	82.5	91.5	84.0	3.3	2.0
13	75.0	74.3	94.2	82.9	91.7	85.3	3.3	2.3
14	74.9	72.7	94.6	82.4	90.5	83.6	3.4	2.2
15	75.5	74.5	95.1	83.6	92.4	84.2	3.0	2.0
Mean Value	75.26	73.84	94.94	82.74	91.18	84.16	3.14	2.10

votes are given for the uniform heat floor panel condition.

In Table 2 similar data for five tests with uniform ceiling heating are given.

By the use of long periods of pretest equilibration, the desired mean air-radiant temperature at the 36 in. level (room center) was held within the limits of 74.3 to 75.4 F. Floor temperatures averaged near 79 F, and ceiling temperatures very near 95 F, in the respective series for floor and ceiling radiant heating. Mean exposed skin and clothing temperature was nearly identical for the two conditions of heating. The heated floor series showed a mean subject surface temperature value only 0.5 deg different from the ceiling series. In both series, extreme values for individual tests differed by 2 deg with the variation around the mean being approximately 1 F ±.

Since conclusions are appropriately based upon mean values, the close agreement of both mean room center globe temperature and mean subject surface temperature warrants the statement that in both heating variations the conditions were comparable in an overall thermal sense.

Local Surface Temperature of Subjects

When the head and lower extremity temperatures are examined, it is immediately apparent that substantial differences exist between the ceiling and floor heating with respect to local temperatures, despite closely comparable mean values for subject surface. When floor heating is used, the lower extremities are nearly 2 F warmer than when ceiling heating is used. In similar fashion head temperatures in ceiling heating series exceed those in the floor series by 0.8 to 0.9 F.

The differences are not large in an absolute sense; however, if we consider these differences in relation to the gradient between room temperature and the body surface, which is the proper method, the variation in clothing surface temperature of the lower extremities is considerable (as noted in Table 3).

From Table 3 it is apparent that when the total room center globe thermometer heating effect is comparable in two tests, provision of heat by a uniformly heated floor panel increases the gradient between lower extremities and the mean environmental temperature by approximately 28 percent as compared with the ceiling heating conditions. This means that in floor heating a larger proportion of heat is being lost to the environment through the legs and this may reasonably be attributed to the dilating effect of higher contact floor temperatures on the blood vessels of the lower extremities.

In contrast to this, it is seen from Table 3 that the location of a heating source in the ceiling has produced an increase in head to environment gradient of less than 5 percent as compared with the gradient observed for the floor heating conditions.

While these results are not greatly surprising, they are worth emphasizing since the authors have not found any published data on this point. It is quite clear that a much larger change in the relative heat loss from legs and head is produced by floor heating than by ceiling heating.

Comfort and Temperature Votes

The foregoing objective data are confirmed by the mean results on comfort and temperature votes. Although the total heating effect of both environments is almost exactly equal in a physical sense, the subjects' mean vote classified the floor heating conditions as comfortably warm in two tests, and in three others varied their votes between comfortable and comfortably warm.

In the ceiling heating series the mean vote indicated substantially less frequent votes of comfortably

Table 3—Percentage Change in Temperature Gradient Between Head and Lower Extremities and 36 in. Mean Air-Radiant Temperature
Temperature Produced by Ceiling and Floor Heating in Tests in which the Total Heating Effect is Comparable

	Ceiling Heating, F		Floor Heating, F	Difference
36 in. Mean Air-Radiant temperature	75.26		74.96	
Mean lower extremity temperature	82.74	Percent increase in lower extremity temperature gradient produced by floor heating as compared with ceiling heating + 27.8 percent	84.52	
Gradient	7.48		9.56	2.08
Mean Head Temperature	91.18	Percent increase in head temperature gradient produced by ceiling heating as compared with floor heating + 3.5 percent	90.34	
Gradient	15.92		15.38	0.54

warm. The separate votes taken on the 3-step temperature sensation scale as a check (without mention of comfort) confirmed the foregoing observations.

Discussion

The ideal indoor conditions of environmental temperature, humidity, and air movement are probably realized for most individuals living in the temperate zones during the relatively short transition periods between spring and summer, and summer and fall. During these periods, external temperatures of the order of 65 to 70 F require little or no positive heating. Sun effects and minor indoor loads result in indoor air and wall temperatures of the order of 70-72 F. This small indoor-outdoor thermal gradient, in conjunction with open windows and mild outside wind effect, results in a general indoor atmospheric environment of very pleasant character, and one probably unequalled by any practical heating system during the cold months.

In this laboratory the general physiological criteria of thermal comfort have been described in many experimental studies.[5] Data drawn from the representative article cited here, and from the survey article on skin temperature and human heat regulation by Sheard[6] make it quite apparent that one of the primary conditions of thermal comfort is a skin temperature ranging from approximately 80 F on the toes and sole of the foot to approximately 95 F on the trunk and certain facial areas, with an overall average for the skin surface of 90-92 F.

The low temperatures on the feet are the net result of (1) a large surface-small volume factor, and (2) the practical circulatory necessity of high vascular tone in the lower extremities as an anti-gravity adjustment favoring competent circulation in the more vital body regions. One of the conditions of an alert subjective state is the maintenance of this vascular tone, and in consequence, foot temperatures are very considerably below the general skin average. The reality of this relation of tone in the lower extremities to their temperature is demonstrated very convincingly by Sheard[6] in relation to the sudden rise in lower extremity temperature with anesthesia and on falling asleep. Since psychic relaxation under conditions which require alertness is closely akin to certain sensations of dullness and fatigue, it appears desirable, in heating procedures, to avoid local heating effects which may induce low vascular tone in the foot and leg.

From this standpoint the data here reported are regarded as sounding a note of caution in the use of floor heating systems. In England floor temperatures above 75 F were seldom required for floor heating installations, and temperatures above this would probably not be tolerated.

During a recent spring day of ideal indoor comfort, the following temperature relations were recorded in this laboratory (subject had been seated quietly for several hours).

Outdoor Air Temp.	68.5 F
Mean Wall Temp.	72.0
Ceiling Temp.	73.5
Floor Temp.	71.1
Air Temp. 30 in. level	70.6
Air Temp. 66 in. level	72.5
Air Temp. 120 in. level	73.3
Outside shoe surface	73.9
Ventral skin of foot	87.7
Lower surface of toes	84.6
Skin surface of calf	91.1
Skin surface of thigh	92.5
Skin of hand and fingers	93.1
Trunk surface	95.0
Cheek	95.8

It is obvious from the foregoing data that outside shoe temperatures are 10 deg or more below foot surface temperature. It is also clear that with floor temperatures of the order of 80 F, the skin surface temperature of the foot must rise considerably above the range of 78 F to 85 F that has been observed for a group of individuals with comfortable conditions and floor temperatures of the order of 70 F.

The data of this experimental study plus the foregoing observations make it highly probable that (*a*) floor temperatures above 75 F are physiologically undesirable, and that (*b*) 80 F can be taken as the level at which the local effect of floor heat is clearly demonstrable in the lower extremities when contrasted with ceiling location for the radiant panel.

Conclusions

1. At a room center black body temperature of 75 F, radiant floor panels operating at 79 F produce a detectable increase in the temperature of the clothing surface of the lower extremities. Under these conditions the gradient between extremities and environment is increased about 28 percent over comparable heating with ceiling panels operating at 95 F.

2. Foot temperatures under comfortable conditions requiring no house heating are about 10 deg above shoe surface temperatures which are near 74 F when floors are at 71 F, other surfaces and air temperatures being within 3 deg of this value.

3. Physiological considerations are reported which support the view that floor temperatures above 75 F are not desirable.

4. Since ceiling location of the radiant panel does not produce a significant effect on head temperature, this location for a radiant panel is preferred to the floor location.

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Humidity Control Important in Railway Air Conditioning

INDIVIDUAL control by passengers of the heating and air conditioning apparatus, with special attention to humidity variations, is a feature of the railway sleeping cars now being used by the Pennsylvania Railroad on its 15-car trains making the New York-Chicago run.

The sleeping cars are equipped with a 7-ton electro mechanical air conditioning system employing Freon as a refrigerant on a direct expansion basis. The refrigerating apparatus, which is located beneath the car floor, consists of two package units, one of which houses the four-cylinder, 3⅛ in. x 3⅛ in., 565-rpm, vertical air cooled compressor, with a belt driven 12-hp, 97-160 volt, d-c, 2050/1300 rpm motor. The other unit includes a two-element evaporative condenser, fin and tube type, having 800 sq ft total surface, with condenser fans rated at 8000 cfm total air and direct connected to a 1-hp, 1750-rpm, 220-volt, 3-phase, 60-cycle, squirrel cage motor, a liquid receiver and a high-low pressure cutout and safety switch.

The overhead air conditioning unit located at the porter's end of the car consists of three elements: (1) a low pressure steam heating coil having 120 sq ft of surface rated 120,000 Btu per hr; (2) a split type 50/50 evaporator having 560 sq ft of total surface rated at 96,000 Btu per hr (maximum), arranged for modulated control; and (3) a duplex centrifugal fan, 2000-cfm at 1 in. static pressure whose belt is driven by a 1-hp, 1725-rpm, 220-volt, 3-phase, 60-cycle, squirrel cage motor.

The air distribution system consists of two overhead ducts, one for supplying conditioned air to each of the 21 rooms, approximately 100 cfm to each room, through a ceiling type diffuser and the other duct providing for the removal of approximately 25 cfm of vitiated air from each room through a ceiling grille. The recirculated air is returned from each room at approximately 70 cfm through a 10 in. x 12 in. door grille to the passageway and from thence to the overhead air conditioning unit at the end of the car through two 16 in. x 20 in. x 2 in. permanent type viscous air filters. A 20 in. x 25 in. x 2 in. viscous filter of the same type is employed on the fresh air intake.

The main exhaust fan is a centrifugal type unit, 600 cfm at ¾ in. static pressure, driven by a ¼-hp, 220-volt, split capacitor type, 60-cycle a-c motor. In addition to the main exhaust fan at the end of the car, there is an 8 in. propeller type exhaust fan for 100 cfm driven by a 1/10-hp, 220-volt, 60-cycle shaded pole a-c motor in the general toilet and a similar exhaust fan in the electrical locker.

For emergency use, there is in each room a small 8 in. circulating propeller type fan having rubber blades and arranged for 3-speed service on 110 volts d-c.

The car is insulated with 3 in. thickness of mineral wool in the ceiling, side walls and floor and the conditioned air duct is insulated with 1 in. of mineral wool. The windows, with approximately 175 sq ft of total surface, are of the double glazed type having ¼ in. safety glass for the inside pane and a ¼ in. heat resisting glass for the outside pane with a ¼ in. dead air space between the panes.

Conditioning Controlled by 3-Position Selector

The air conditioning is controlled by a single selector switch having three positions. The selection between cooling, heating, and ventilating is automatically obtained by means of three thermostats in the fresh air stream; above 60 F, cooling is available when required by inside air temperatures, below 58 F overhead heat is available, and below 50 F floor heat is available. The four cooling thermostats, two for day service and two for night service, are located behind the recirculated air filters; for day service, 76 F (full cooling) to 73 F (reduced cooling), and for night service, 74 F (full cooling), to 71 F (reduced cooling). The cooling effect in each room can be regulated by adjusting the damper associated with the room diffuser. The cooling and heating are electrically interlocked to prevent simultaneous operation of both systems.

If the conventional type of *start-stop* method of cooling control were employed, the humidity in the car would rise objectionably during the *off* periods because of the evaporation of moisture from the evaporator surface and also because of the addition of moisture contained in the fresh air admitted to the car and the moisture contributed by the passengers during these intervals. To overcome this very undesirable condition, the compressor runs continuously and as the demand for cooling decreases, the compressor motor speed is reduced and the amount of active surface in the evaporator is correspondingly decreased by the closing of a solenoid valve in the liquid line supplying refrigerant to one-half of the evaporator.

The compressor motor starter is of the reduced voltage type to prevent heavy drains on the battery during starting periods, and a low voltage relay is employed to avoid complete battery discharge when operating over long periods direct from the battery. The compressor motor control is electrically inter-

locked with the blower motor control, so that the compressor motor cannot operate unless the blower motor is running.

The overhead heat is automatically controlled by a modulating steam valve having three thermal elements: one in the fresh air stream which automatically raises the operating temperature as the outside air temperature drops; one in the return air; and one in the outlet air stream from the unit. These latter two elements function to hold proper air temperature in the car.

Floor Heat Thermostatically Controlled

The floor heat in each room is thermostatically controlled by a modulating steam supply valve. The thermostatic setting can be manually adjusted for holding various temperatures in the room from 60 F to 80 F. A 60 F thermostat controls the heating of the car to prevent freezing during parked periods. Each room has its own floor radiation consisting of two $\frac{7}{8}$ in. OD copper tubes having common copper fins, $1\frac{7}{8}$ in. x 4 in. spaced four per inch, having a rating of approximately 4500 Btu per room.

Steam for the operation of the heating system is obtained from a $2\frac{1}{2}$ in. diameter train line and the pressure is reduced through pressure regulating valves to approximately 10 lb on each car.

EARNINGS OF YOUNG ENGINEERS INCREASE

Salaries of younger engineers have increased relative to those of more experienced men in recent years. Earnings of beginning electrical engineers, for example, increased 66 percent from 1929 to 1946, those of engineers with 10 years of experience, 22 percent and those of men with 25 years experience, 11 percent.

The greatest increase in earnings of engineers occurs in the first 10 years of experience; after about 30 years of experience there tends to be a leveling off of average salaries.

Honored by Life Membership

LOUIS K. BERMAN

—President, Raisler Corp., New York, N. Y., since 1930.
—Entered Raisler Corp. in 1905; has been successively: draftsman, engineer, superintendent, general manager, in design and construction of heating and air conditioning systems.
—Former Vice President New York Chapter ASHVE. Former Treasurer *Heating, Piping and Air Conditioning Contractors New York City Association.*
—Born and educated in New York City; graduate of the College of the City of New York.

JOHN A. DARTS

—Executive Vice President, Fitzgibbons Boiler Co., Inc., New York, since 1947; Vice President, 1937-47.
—From 1921 to 1937 sales manager, Kewanee Boiler Co., Inc., New York, N. Y.; 1911 to 1921, sales engineer.
—1903 to 1911 Titusville Iron Co., Titusville, Pa. and New York.
—For sixteen years, member of Heating Boiler Sub-Committee of *ASME* Boiler Code Committee.

EARLE SHULTZ

—Vice President, Illinois Maintenance Co., Chicago, since 1918.
—Author of brochures on buildings and on heating and lighting plants.
—Specialist in office building management; manager, Edison Building since 1912; manager, Marquette Building since 1928.
—Member of *National Association of Building Owners and Managers* (president 1922-24); president, 1925-29, of *Chicago Building Managers' Association;* president, *NDHA*, 1925.
—Graduated from Ottawa University, Kansas.

ALBERT WEGMANN

—Owner, A. Wegmann Co., sheet metal contractors, Philadelphia, Pa.
—Superintendent, sheet metal department, S. Faith & Co., Philadelphia, from 1910-18; designed hot blast and ventilating systems and blowers.
—Formerly blower-ventilation engineer, W. J. Donovan Co., Philadelphia.
—Born in Switzerland; joined the Society in 1918.

AIR POLLUTION SYMPOSIUM TO BE HELD IN NOVEMBER

Intended to stimulate interest in important problems of air pollution, the National Air Pollution Symposium will be held on November 10 - 11, 1949 at the Huntington Hotel, Pasadena, Calif. The symposium is to be presented by Stanford Research Institute in cooperation with the California Institute of Technology, the University of California and the University of Southern California. The two-day symposium will cover the following: biological and medical effects on plants and animals; effects on visibility; meteorological aspects; methods of sampling and analysis; reduction or elimination of air pollution at its source; and influence of air pollution on industrial planning and plant location.

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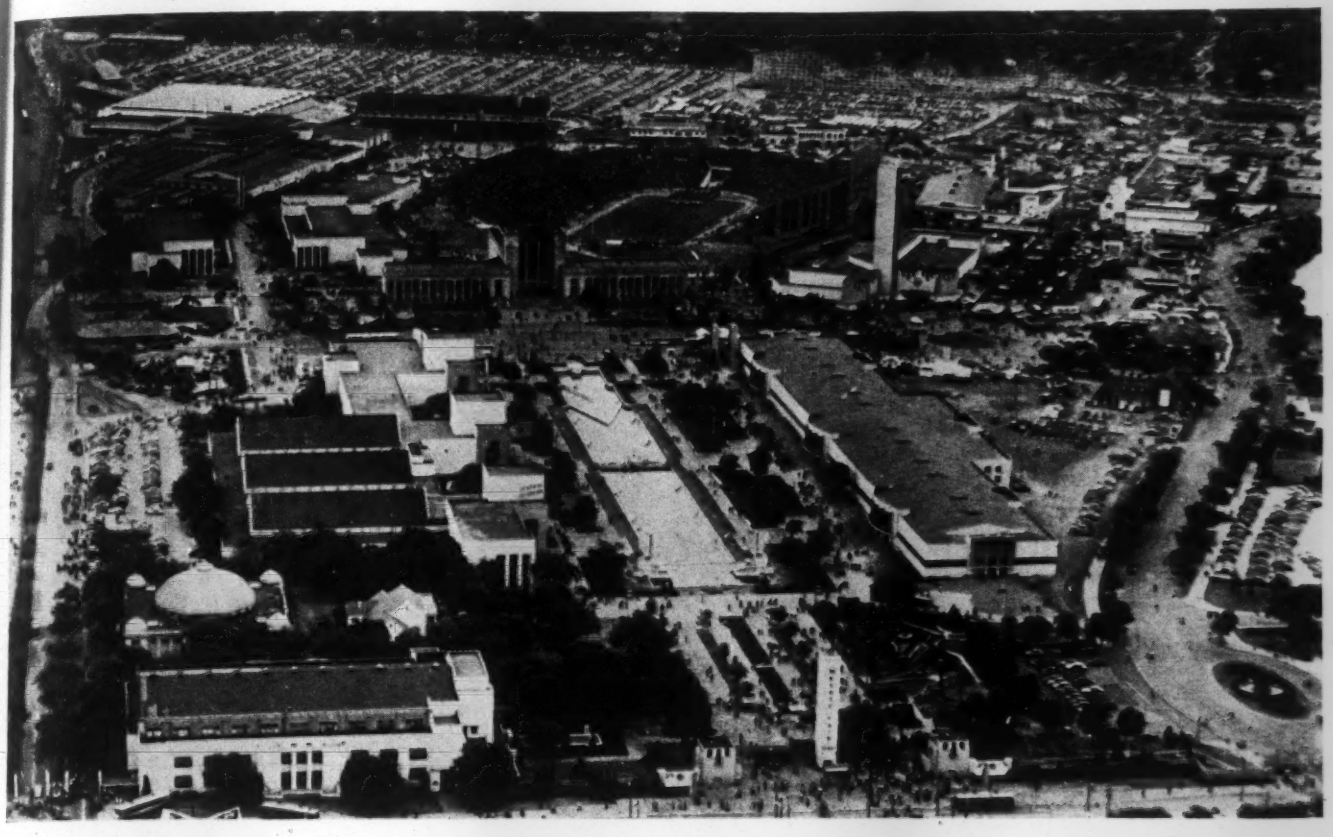


State Fair Grounds

Plans Progressing Rapidly in Dallas as 56th Annual Meeting Approaches

January 23-27, 1950

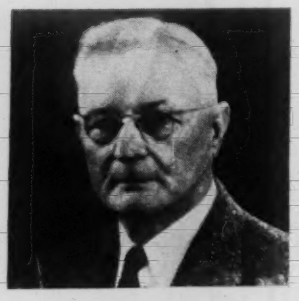
PLANS are well under way in Dallas, Tex., for the 56th Annual Meeting of the ASHVE, January 23-27, 1950, according to the latest word from C. Rollins Gardner, general chairman of the Committee on Arrangements, who has just released the complete list of the personnel of the various committees assisting him in planning a program of technical sessions, as well as entertainment for all. Headquarters for the meeting will be at the Adolphus and Baker Hotels.

Dallas is just a little over 100 years old, but is today a financial, rail, oil and agricultural center. With a population of more than a half-million, the city has 400 churches, 69 elementary schools and 15 high schools. It has a total of nearly 5000 acres of developed recreational facilities. It has the council-manager form of city government. It has two daily newspapers, *The Dallas Morning Press*, and the *Daily Times Herald*.

The climate is dry and temperate, the average growing season, or period between frosts, is 243 days, and the annual temperature normal in and around Dallas is 65.7 which is only about 3 deg difference from the annual temperature average of Los Angeles. The average relative humidity is 53 percent at noon and 49 percent at 7 p.m.

Daily flights to Dallas include 91 scheduled arrivals and 91 scheduled departures of airplanes, with direct services from Dallas to cities like Los Angeles, Denver, Chicago, Detroit, Cleveland, New York, Boston, Savannah, Atlanta, New Orleans, Houston, and Mexico City.

The railroads serving Dallas are: Burlington Lines, Cotton Belt Route, Frisco Lines, Santa Fe Lines, Kansas City Southern Lines, Missouri-Kansas-Texas Lines, Rock Island Lines, Southern Pacific Lines,

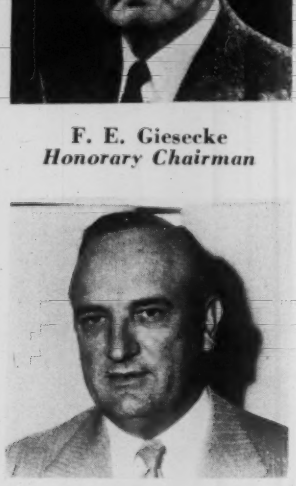


F. E. Giesecke
Honorary Chairman

C. Rollins Gardner
General Chairman

G. A. Linskie
Vice Chairman

Reg F. Taylor
Honorary Chairman



M. L. Brown

Annual Meeting 1950–Dallas

Committee on Arrangements

C. Rollins Gardner, *General Chairman*

G. A. Linskie, *Vice Chairman*

Honorary Chairmen

F. E. Giesecke Reg F. Taylor

Banquet—M. L. Brown, *Chairman;* J. P. Dillard, J. R. Dowdell, W. E. Frost, E. J. Stern.

Entertainment—R. E. Allison, *Chairman;* A. B. Carter, V. C. Kneese, James O'Connor, Jr., A. A. Stone, J. L. Tye.

Exposition—Oslin Nation, *Chairman;* W. R. Barbeck, S. S. Brandt, N. R. Collins, Jr., F. L. Gray, Jr., R. G. Lyford.

Finance—E. T. Gessell, *Chairman;* J. B. Lowe, J. F. Marshall, R. R. Matthews.

Ladies—T. H. Anspacher, *Chairman;* R. R. Brient, Jr., R. A. Mixon, J. D. Poythress. *Assisted by:* Mmes. T. H. Anspacher, J. P. Ashcraft, W. R. Barbeck, Herman Blum, Jr., M. L. Brown, J. P. Dillard, C. Rollins Gardner, E. T. Gessell, D. C. Kieffer, V. C. Kneese, G. A. Linskie, Oslin Nation, J. A. Ray, P. N. Vinther.

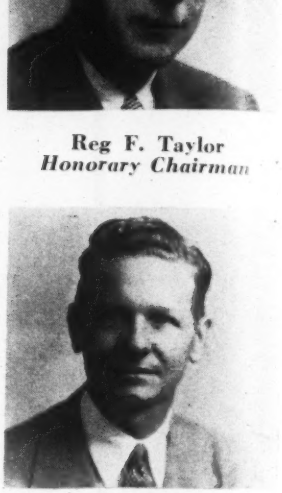
Publicity—J. P. Ashcraft, *Chairman;* D. L. Echols, E. J. Hatzenbuehler.

Reception—W. R. Barbeck, *Chairman;* S. E. Ammons, A. F. Avera, J. A. Bishop, M. W. Brown, H. M. Cunningham, E. E. Farrow, D. W. Harrington, T. M. Jones, R. C. Knight, B. W. Levy, C. H. McLeod, M. J. Murray, H. G. Walcott, K. L. Wilson.

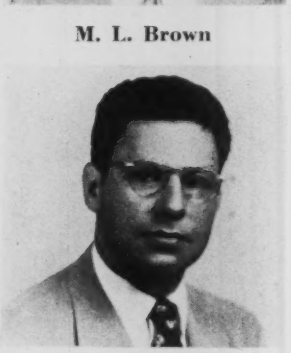
Sessions—P. N. Vinther, *Chairman;* J. W. Lacy, D. C. Pfeiffer, R. A. Walker.

Special Events—Herman Blum, Jr., *Chairman;* R. M. Burgess, Fred Downs, R. A. Mayes, I. P. Newby.

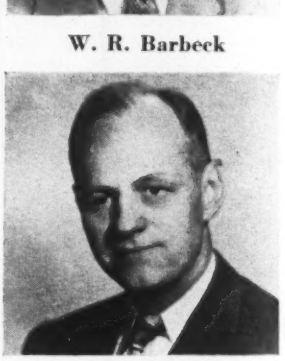
Transportation—J. A. Ray, *Chairman;* C. F. Gilmore, M. O. Tessman, Jr., C. C. Young.



W. R. Barbeck



Herman Blum, Jr.



P. N. Vinther

T. H. Anspacher

R. E. Allison

Oslin Nation

E. T. Gessell

J. P. Ashcraft

J. A. Ray

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and Texas and Pacific Railway Co. Home offices of the Texas & Pacific and the Missouri - Kansas - Texas Lines of Texas are in Dallas. There is through Pullman service from many eastern, mid-western and northern cities.

Dallas has more than 130 hotels, large and small, and 90 tourist courts, with total guest capacity of approximately 25,000 persons. The city's eight largest downtown hotels include the Hotel Adolphus and the Baker Hotel and have a total of more than 3,000 rooms. The Adolphus and the Baker Hotels are shown in the picture at the right.

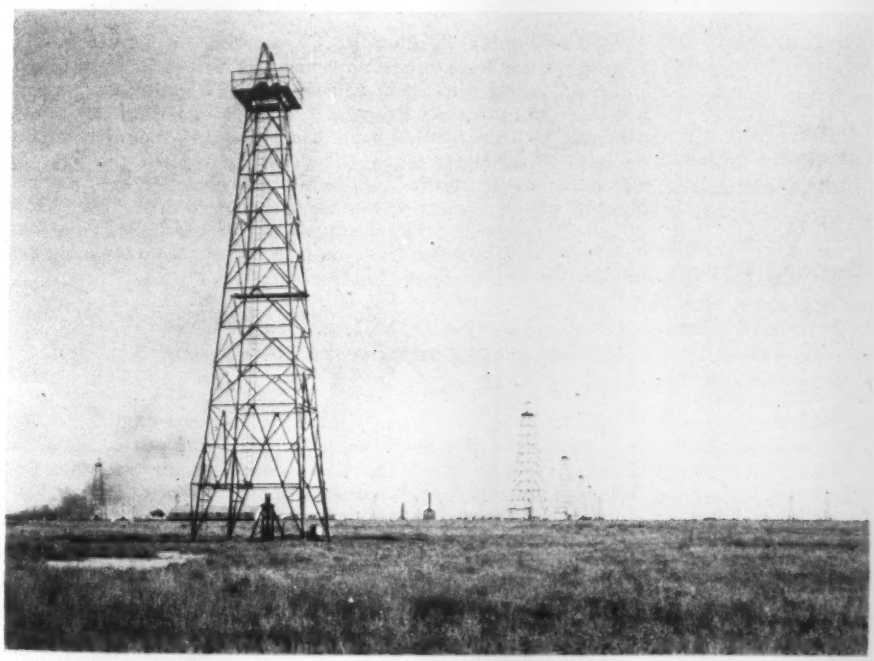
Downtown Dallas showing Adolphus and Baker Hotels in foreground

Scene of the Exposition

The Southwest Air Conditioning Exposition is to be held in two buildings on the State Fair Grounds, which contain 187 acres and are about 10 minutes by street car or bus from the Adolphus and Baker Hotels. Also located on the Fair Grounds are the principal museums, exhibiting natural history, paintings and sculpture.

The Exposition will bring to Dallas the latest and best in ideas and practice in heating, ventilating and air conditioning. Equipment, materials and methods pointing toward economy in operations will be featured and should be of interest to not only heating and ventilating engineers, but also to architects, contractors, building owners and managers, home owners, builders, dealers and distributors.

Among the groups of exhibits will be combustion, hydraulic, steam and hot water heating, refrigerating equipment, controls, and insulation. It is expected that 200 manufacturers will have exhibits.



Pumping derricks are familiar sights of the Texas landscape

LA SALVIA APPOINTED TO CLEVELAND BUILDING BOARD

Among the five appointments to Cleveland's new Board of Building Standards and Appeals is J. J. La Salvia, chief engineer, The Osborn Engineering Co., Cleveland, Ohio. The appointments were made by the city's mayor.

Mr. La Salvia, a member of the Society since 1930, is the mechanical engineering representative on the Board. The other four members represent the architectural, structural engineering, building and labor groups. The Board of Building Standards and Appeals will interpret air conditioning, refrigeration, heating, ventilating, plumbing and all other mechanical sections of the code.

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1950 NOMINATIONS

Officers and Council

The Nominating Committee selected in accordance with the provisions of **Article B-VIII**—*Section 11* of the By-Laws, has submitted its selection of nominees for Officers and members of Council in 1950, as follows:

President
LESTER T. AVERY, Cleveland, Ohio.

First Vice President
LAUREN E. SEELEY, Durham, N. H.

Second Vice President
ERNEST SZEKELY, Milwaukee, Wis.

Treasurer
REG F. TAYLOR, Houston, Tex.

Members of Council—*Three-Year Term*
JOHN E. HAINES, Minneapolis, Minn.
JOHN W. JAMES, Chicago, Ill.
E. R. QUEER, State College, Pa.
GRAEME B. SUPPLE, Indianapolis, Ind.

Respectfully submitted,

NOMINATING COMMITTEE

C. H. Pesterfield, *Chairman*
N. H. Peterson, *Vice Chairman*
W. Bruce Morrison, *Secretary*

P. L. Charles	R. T. Kern
E. L. Crosby	W. A. Kuechenberg
A. W. Edwards	D. M. Mills
L. C. Gross	G. W. F. Myers

Alternates

R. H. Carpenter	C. H. Turland

In accordance with the provisions of the Society's Constitution, By-Laws, and Rules, ballots containing the names of the above candidates will be sent to the membership for voting upon prior to the Annual Meeting in January.

Article B-IX—*Section 1.* Twenty (20) or more members of the Society, eligible to vote, may present to the Secretary, over their signatures, the name of any member eligible to hold office in the Society as a candidate for any office, provided such name is presented at least sixty (60) days preceding the next Annual Meeting, together with the written consent of the nominee to fill the office for which he has been selected, and the Secretary shall place such names on the ballot, with special notation that they are presented by members independent of the Nominating Committee report. Any member nominated for any office may withdraw his name as a candidate, whether nominated by the regular Nominating Committee or by twenty (20) or more members, providing he does so at least forty-five (45) days prior to the next Annual Meeting.

Article B-IX—*Section 2.* The secretary shall prepare ballots with the names of all candidates and forward them to the members eligible to vote, at least twenty (20) days and not more than forty (40) days before the date of the Annual Meeting.

Members of Committee on Research

Although committees of the Society are usually appointed, in view of the great importance of the Committee on Research and the responsibility it would be called upon to assume, it has been made more representative of the entire membership of the Society by a process of *election*. The election is governed by the By-Laws for the election of officers, with the single exception that Members of the Committee on Research are nominated by the Council instead of by a Nominating Committee.

In accordance with the Provisions of **Article B-VIII**—*Section 9*, the Council announces the nomination of the following members of the Committee for election to succeed those members whose present terms expire January, 1950.

Committee on Research—*Three-Year Term*
CARL F. BOESTER, Lafayette, Ind.
ROBERT C. CROSS, Chicago, Ill.
RICHARD S. DILL, Washington, D. C.
ARTHUR J. HESS, Los Angeles, Calif.
HAROLD A. LOCKHART, Chicago, Ill.

The regulations governing the nomination and election of members of the Committee on Research are as follows:

Article B-VIII—*Section 9.* COMMITTEE ON RESEARCH—The Committee on Research shall consist of fifteen (15) members and shall function in accordance with the Regulations governing the Committee on Research. The Council shall nominate, previous to July first of each year, five (5) members of the Society, to serve for three (3) years, to replace the five (5) members, whose terms expire at the close of the Annual Meeting of the Society following such nomination. The Council shall designate the nominees by letter-ballot, and the Secretary shall publish the names of the candidates nominated in the October issue of the JOURNAL.

REGULATIONS GOVERNING THE COMMITTEE ON RESEARCH

Article II—*Section 1*

(c) Any ten (10) members of the Society eligible to vote may present to the Secretary over their signatures, the name of one (1) or more additional nominees for the Committee on Research, provided such name or names are presented at least sixty (60) days prior to the next Annual Meeting, and such additional nominations shall be placed on the ballot opposite the nominations made by the Council.

(d) The election shall otherwise conform to the regulations provided for the election of officers of the Society in the Constitution, By-Laws and Rules.

(e) Vacancies may be filled by the Council, such persons chosen by the Council to serve until a successor is elected at the next Annual Meeting.

NOMINEES FOR 1950 OFFICERS

For President—Lester T. Avery was born in Painesville, Ohio, in 1896. After receiving his B.S. degree from Case Institute of Technology he served in the United States Naval Reserve until the end of World War I. In 1921 he became district manager of the American Carbonic Machinery Co. From 1929 to the present, he has been president of his own organization, the Avery Engineering Co., Cleveland, Ohio. He is also president of the newly formed Avery Products Co., and is a registered professional engineer in the state of Ohio.

Lester T. Avery
Cleveland, Ohio

A member of the Society since 1934, he was on the Council and many other committees before serving as second and first vice presidents. He has been active also in the Society's Northern Ohio Chapter, of which he was president in 1936-37. At the 46th Annual Meeting of the ASHVE at Cleveland in 1940, he acted as general chairman of the Committee on Arrangements.

He is a member of the *ASRE*, Cleveland Rotary Club, Cleveland Chamber of Commerce, Case Alumni Association, *Cleveland Engineering Society, Air Conditioning Association, Inc., of Cleveland,* and Beta Theta Pi fraternity. He is listed in *Who's Who in America* and *Who's Who in Engineering*. He has contributed many articles to technical journals.

For First Vice President—Lauren E. Seeley, a native of Connecticut, is now Dean of the College of Technology, University of New Hampshire, Durham, N. H. He was born in 1898 and was educated at Yale University, receiving a Ph.B., an M.E., and an LL.B.

During his studies, he taught mechanical engineering. In 1925 he was put in charge of a heating and ventilating course. He remained at Yale until 1945 when he became dean at the University of New Hampshire.

In World War II Dean Seeley was regional advisor in Connecticut and Rhode Island for the engineering, science and management war training program of the U. S. Office of Education. He was also special consultant to the OPA on fuel oil and coal rationing problems, and consultant on engineering and manpower problems for a number of government agencies, trade associations and private firms.

Lauren E. Seeley
Durham, N. H.

His research work has been concerned chiefly with heating and ventilating, including studies of wood burning devices and the effect of relative humidity on the respiratory system. He is the author of numerous technical codes and papers which have been published in the Society's JOURNAL and TRANSACTIONS.

A member of the Society since 1930, he was elected in 1944 to the Society's Council for three years, during which time he served as chairman of the Publication Committee and as member of the Finance, Executive and Standards Committees. He was elected president of the Connecticut Chapter during the 1940-41 season. In 1947 he was elected treasurer of the Society. Dean Seeley, a member of Massachusetts Chapter of ASHVE since 1947, is also a member of the *ASME*, Sigma Xi and Tau Beta Pi Fraternities.

For Second Vice President—Ernest Szekely, president, Bayley Blower Co., Milwaukee, Wis., was born in 1888. He received an M.E. degree from the University of Budapest in 1910.

For two years he was assistant professor of thermodynamics, heating and ventilating at the University. In 1921 he became associated with Jeffery Mfg. Co. and Guarantee Construction Co., New York, where he designed elevating systems and did general engineering work. In 1914 he joined the staff of the American Blower Co. at Detroit, as research engineer in heating and ventilating.

Ernest Szekely
Milwaukee, Wis.

Mr. Szekely has been an ASHVE member since 1920, and has been active in both the Northern Ohio and Wisconsin Chapters. He served as a member of the Council from

1945 to 1947, and on many Society committees, including the Nominating, Code Committee for Exhaust Systems, and several technical advisory committees and is now chairman of the TAC on Air Distribution.

He was vice president and president of the Northern Ohio Chapter in 1923 and 1924, and second vice president, first vice president and president of the Wisconsin Chapter from 1933-35. He was elected president of the *Engineers' Society of Milwaukee* 1946-47.

Mr. Szekely has published engineering articles in the technical field and is among those listed in *Who's Who in Engineering*. He is a member of the Rotary Club.

Reg F. Taylor
Houston, Tex.

For Treasurer—Reg F. Taylor, consulting engineer, was born in Canada, and was educated in England and Pietermaritzburg, Natal, South Africa. He is now a naturalized citizen of the United States.

Mr. Taylor served an engineering apprenticeship in Pietermaritzburg, and came to the United States in 1908, when he became associated with the Dunham Engineering Co., Ft. Worth, Tex. During World War I he was a member of Co. E, 110th Engineers, 35th Division (Kansas-Missouri) with one year overseas duty. After the war, he entered private practice as consulting engineer in Dallas, maintaining this office until 1936 when he transferred it to Houston and continued practice there.

Mr. Taylor was a charter member of the Kansas City Chapter, and when the Texas Chapter was organized in 1937, he became its president. With the division of the Chapter into the North and South Texas Chapters, he served as president of the South Texas Chapter in 1939. He was a member of the 1946 Chapter Relations Committee, and its chairman in 1947 and chairman of the 1948 Membership Committee. He is now serving the third year of a three-year term on ASHVE Council and is chairman of the Program and Papers Committee.

He is a member of the *Texas Society of Professional Engineers, AIEE*, Houston Engineers Club, and Houston Rotary Club.

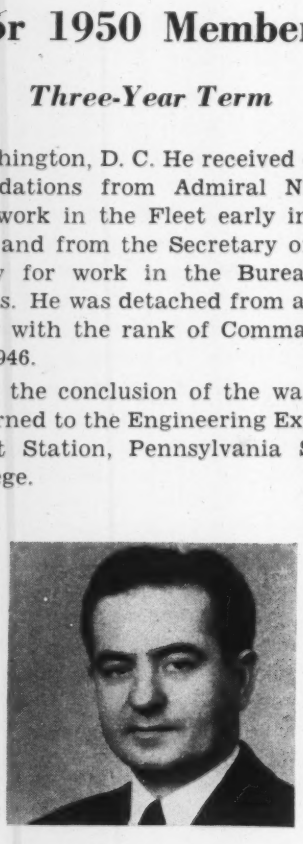
Nominees For 1950 Members of Council

Three-Year Term

Elmer R. Queer, State College, Pa., professor of Engineering Research in charge of the Thermal Research Laboratory, Pennsylvania State College, was born on May 26, 1904, at Johnstown, Pa. He attended Pennsylvania State College, receiving his B.S. degree in electrical engineering in 1926 and his M.S. in 1928. While preparing for his M.S. he was an Elliot Research Fellow in the Engineering Experiment Station.

From 1928 until 1934 he was engaged in thermal research on building and insulating materials at the college. In 1934 he became an assistant professor in Engineering Research, where in addition to doing thermal research he conducted heat transmission tests on naval warship construction for the U. S. Navy. In 1941 Professor Queer was called to active service in the Navy and after a tour of duty at sea, was stationed at the Bureau of Ships, Washington, D. C. He received commendations from Admiral Nimitz for work in the Fleet early in the war and from the Secretary of the Navy for work in the Bureau of Ships. He was detached from active duty with the rank of Commander in 1946.

At the conclusion of the war, he returned to the Engineering Experiment Station, Pennsylvania State College.



E. R. Queer
State College, Pa.

Since joining the Society in 1933, he has submitted numerous papers for publication in the JOURNAL and TRANSACTIONS. He has served as chairman of the Committee on Admission and Advancement. He is now a member of the Federal Liaison Committee, and a member of the Committee on Research. He has acted as chairman of the TAC on Insulation, as a member of the TAC on Navy Studies, and is now on the TAC on Air Sterilization.

Professor Queer is a member of the *Society of Naval Architects and Marine Engineers, U. S. Naval Institute*, and Sigma Xi fraternity.

John E. Haines, vice president, Minneapolis - Honeywell Regulator Co., Minneapolis, Minn., has been active in the Society as author, lecturer and committee member. From 1945 to the present, he has served

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John E. Haines
Minneapolis, Minn.

on the Chapter Delegates Committee and has been chairman of the Nominating Committee. He is at present chairman of the Committee on Promotion of Research.

During the past eight years, he has spoken on automatic controls before many ASHVE Chapter meetings. In June of this year, he was general chairman of the Committee on Arrangements which had charge of the 1949 Semi-Annual Meeting at Minneapolis. He has also been active in the Minnesota Chapter, serving as vice president and president from 1945 to 1947.

Mr. Haines was born in Noblesville, Ind. and was educated at Purdue University, Lafayette, Ind., receiving a B.S. degree in chemical engineering. In 1929, he joined the sales department of the Minneapolis-Honeywell Regulator Co. and in 1940 was made manager of the Commercial Controls Division. In 1945, he became a vice president of the firm.

He has written many articles on automatic controls and their applications and he recently completed a textbook on the subject of automatic controls which will be published soon.

He has been a member of the Society since 1940 and is also a member of the *ASRE*.

John W. James, Chicago, Ill., chief research engineer, McDonnell & Miller, Inc., was graduated from Oregon State College with a B.S. and from the University of Wisconsin with an M.S., both degrees in mechanical engineering.

Following graduation from Oregon State, he was employed by G. E. Reed, consulting engineer, in whose office he remained until 1932. In 1932 he began a two-year research fellowship in the Department of Mechanical Engineering, University of Wisconsin. In 1934 he was appointed engineer for General Electric Co., Schenectady, N. Y., in the air conditioning laboratory.

In 1935 he was made Technical Assistant of ASHVE and later Technical Secretary. During his seven

John W. James
Chicago, Ill.

years' service with the Society his responsibilities included the preparation of technical data for THE GUIDE, the correlation and administration of the cooperative research program of the Society, and work with the technical and code committees.

In February 1943, he became development engineer with Iron Fireman Mfg. Co., Cleveland, Ohio. In 1948 he became associated with McDonnell & Miller, Inc., Chicago, as chief research engineer.

As a Society member, he has served two terms on the Committee on Research, 1944-45, 1947-49 and is now vice chairman; chairman of the Publication Committee, 1947-48; and chairman, *Group B*, TAC on Panel Heating and Cooling, 1947-49. He has also served as a member of the Society's Constitution and By-Laws, Nominating, Publication Policy and Guide Publication Committees.

He is now affiliated with the Illinois Chapter of ASHVE and was president of the Northern Ohio Chapter in 1947. He also belongs to *ASME* and Sigma Xi.

Graeme B. Supple
Indianapolis, Ind.

Graeme B. Supple, district manager, American Blower Corp., Indianapolis, Ind., is a licensed professional engineer in the State of Indiana. He joined the Society in 1934 and has served on several Chapter Delegates Committees (1944-48), on the chapter nominating committee (1944-46) and on the Regional Nominating Committee (1948). He is a past president of the Indiana Chapter (1945), having served as vice president in 1944. He was also a member of the Board of Governors and has been chairman of several chapter committees.

Mr. Supple is a contributor to *Air Conditioning and Engineering*, American Blower Blue Book, and is a member of various technical societies including: *Professional Engineering Society; Air Conditioning Council of Indianapolis;* Construction League of Indianapolis; Indiana Building Code Committee; Pi Tau Sigma; Theta Tau; and Scientech Club of Indianapolis.

He was born in Chicago in 1904 and attended Deerfield, Ill., public school, Deerfield Shields High School and the University of Illinois, Urbana. He holds a B.S. degree in mechanical engineering. As a student, Mr. Supple did engineering research in air handling equipment.

In 1928 he joined the sales department of the American Blower Corp. and worked in several states. He has been associated with sales, design, and supervision of the installation of heating and ventilating equipment. He has designed heating, ventilating, and air conditioning systems for department stores, banks, theaters, and residences, etc.

Nominees For 1950 Committee on Research

Three-Year Term

Carl F. Boester, Lafayette, Ind., housing consultant, Purdue Research Foundation, was born in Chicago, Ill., and educated in St. Louis, Mo.

In 1930 he opened an engineering and contracting business and in 1935 he became an air conditioning

Carl F. Boester
Lafayette, Ind.

engineer in St. Louis, where he was engaged in the research and design of ice actuated cooling systems.

From 1937 to 1939 he devoted much of his time to research and development work in air conditioning, and then joined the Marlo Coil Co., St. Louis. On July 1, 1939 he became director of Housing Research at Purdue University.

As a member of the Society he served as treasurer, secretary, vice president and president of the St. Louis Chapter, and was also a member of many chapter committees. He was a member of the Society's Nominating Committee from 1939-43 and served a three-year term as a member of the Committee on Research. He was chairman of the Research Finance Committee and also on many of the research technical advisory committees. He is now affiliated with the Indiana Chapter of ASHVE. He is currently a member of the Society's Council, chairman of its Standards Committee, as well as chairman of the Society's Chapter Relations Committee.

Mr. Boester has written articles for many of the technical publications. He is also a member of the *ASRE* and of the Building Research Advisory Board, National Research Council.

Robert C. Cross, assistant manager, Merchandise Testing and Development Laboratories, Sears, Roebuck & Co., Chicago, is completing a three-year term on the Society's Committee on Research and has been re-nominated.

Mr. Cross has been a member of ASHVE since 1937 and was chairman of the Guide Publication Committee for the 1949 edition. For two earlier editions (1938-39) he

Robert C. Cross
Chicago, Ill.

contributed to revisions in the chapters on automatic fuel burning equipment and fuels and combustion. As a member of the Committee on Research he served on the TAC on Combustion and on the TAC on Cooling Load.

Mr. Cross was born in Massachusetts and was graduated from Northeastern University with a B.M.E. degree. In 1925, he began his professional career with the H. B. Smith Co., Westfield, Mass., where he was design and test engineer in charge of boiler evaporation tests, combustions studies and oil burner tests.

From 1929 to 1941, Mr. Cross was associated successively with: U. S. Bureau of Mines, Pittsburgh, Pa., as assistant fuel engineer; H. B. Smith Co., as supervising engineer of research; Battelle Memorial Institute, Columbus, Ohio, as fuel engineer; and Schwitzer-Cummins Co. Indianapolis, Ind., as chief of the heating division.

In 1941 he became senior combustion engineer in the testing laboratories of Sears, Roebuck & Co. and later that year became head of the mechanical division. In 1947 he was made assistant manager.

Mr. Cross has written many articles on domestic oil burners, has presented papers at Society meetings and is listed in *Who's Who in Engineering*.

He joined the Society in 1937 and is also a member of *ASME*.

Richard S. Dill is chief, Heating and Air Conditioning Section, National Bureau of Standards, Washington, D. C., and is the author of many technical papers. Subjects

Richard S. Dill
Washington, D. C.

dealt with in his writings include: Domestic Heating and Air Conditioning; Thermal Insulation of Dwelling Houses; A Survey of Test Methods & Rating Limits for Domestic Heating Devices; Dampness in Basements and Ground Floors; Condensation in Buildings.

Since 1939, Mr. Dill has participated in the work of such technical advisory committees of the Society as the TAC on Instruments, TAC

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on Radiation with Gravity Air Circulation, TAC on Fuels and TAC on Air Cleaning, of which he is the present chairman. He was a member of the Guide Publication Committee in 1945 and in 1947 he acted as chairman of that committee. In 1948 he served on the Publication Committee and is its chairman this year.

Mr. Dill is a past president of the Washington, D. C., Chapter, ASHVE. He is a licensed mechanical engineer and a member of the *ASME*, the *ASTM*, the Washington, D.C., Building Congress and the Washington Academy of Sciences.

Mr. Dill was born in 1901 in North Carolina. He was educated at North Carolina State College of Agriculture and Engineering, Raleigh, N. C., receiving a B.S. in mechanical engineering in 1923.

Arthur J. Hess, member-owner, Hess-Greiner & Polland, Los Angeles, Calif., was born in 1904 at Pasadena. He attended the University of California at Los Angeles

Arthur J. Hess
Los Angeles, Calif.

and Berkeley, studying civil engineering.

In 1929 he was in the contracting business and in 1930 he entered practice as a consulting engineer. From 1936 to the present he has been engaged in the application and sale of engineering products. Some of his work included stages at the 20th Century-Fox Studio, the heating, ventilating and air condition Co-op wind tunnel at Pasadena and at Curtiss-Wright; the Earhart Research Laboratory, California Institute of Technology.

He is a member of Southern California Chapter of ASHVE and was its president in 1941, having served as vice president in 1940, secretary in 1938-39 and treasurer in 1937. He was a member of the Committee on Promotion of Research in 1947-48 and is currently a member of the TAC on Sensations of Comfort.

A licensed engineer in the state of California, he has written several articles including *Air Conditioning in Moving Picture Studios; Evaporative Cooling* and *Air Conditioning in Film Laboratories*. He is also a member of *ASRE* and Chi Epsilon.

Harold A. Lockhart, chief engineer, Bell & Gossett Co., Morton Grove, Ill., has served on several technical advisory committees of the Society

Harold A. Lockhart
Morton Grove, Ill.

as follows: TAC on Fluid Flow in Pipes, 1941-42; *Group B*, TAC on Panel Heating and Cooling, 1948-49. He has also been a speaker before many ASHVE chapter meetings on *Forced Hot Water Heating and Piping Systems*.

He was born in 1906 at Nashville, Tenn. As a boy he worked with his father; by the time he was fifteen he was making working drawings, primarily on school house work. Two years later he was virtually in charge of construction on a $150,000 school building in Ohio, all of which decided him to study mechanical engineering. He obtained a B.S. in mechanical engineering at the University of Minnesota, working part time as a carpenter on railroad construction and the last two years as an engineer for the Department of Buildings and Grounds of the University.

After graduation, he worked as research engineer for the Insulite Co., Minneapolis, and later with the Stott Stoker Co.

For the last 15 years as chief engineer at Bell & Gossett he has been in complete charge of the engineering department. He is a licensed engineer in the State of Illinois and also belongs to *ASME* and the Theta Tau fraternity.

TAC ON PHYSIOLOGICAL RESEARCH APPOINTED

Chairman of the recently organized Technical Advisory Committee on Physiological Research for 1949 is Dr. R. W. Keeton, head of the Department of Medicine, University of Illinois, Chicago.

Other members of the committee are: Dr. Thomas Bedford, London School of Hygiene, London, England; Capt. A. R. Behnke, MC, USN, Naval Medical Research Institute, Bethesda, Maryland; Dr. Ernest W. Brown, executive officer, Committee on Scientific Development and Education, American Medical Association, Chicago; Dr. Alan C. Burton, professor of biophysics, Medical School, University of Western Ontario, London, Ontario; Dr. Eugene F. DuBois, professor of physiology, Cornell Medical College, New York, N. Y.; Lt. Col. A. P. Gagge, MSC, USAF, chief, Aero Medical Operations, Wright-Patterson Air Force Base, Dayton, Ohio.

Dr. Ford K. Hick, associate professor, College of Medicine, University of Illinois, Chicago; John W. James, chief research engineer, McDonnell & Miller, Inc., Chicago; Dr. Douglas H. K. Lee, professor of physiological climatology, The Johns Hopkins University, Baltimore, Md.; Dr. Charles Sheard, director emeritus and professor emeritus, experimental biophysics, Mayo Clinic and Mayo Foundation, Rochester, Minn.; Dr. C.-E. A. Winslow, professor emeritus, Yale University School of Medicine, New Haven, Conn.

Summary of Chapter Meetings*

• **ILLINOIS**—August 1949. The following are recently appointed chairmen of committees, according to the announcement of Pres. J. S. Kearney: *Finance*—H. J. Couch; *Membership*—H. E. Anderson; *Membership Advancement*—R. O. Nelson; *Meetings*—J. H. Clarke; *Publicity*—T. V. Johnson.

• **KANSAS CITY**—August 1949. During the summer, various chapter committee chairmen were appointed as follows by Pres. Henry Nottberg, Jr.: *program*—W. E. Howarth; *attendance*—E. E. Ralston; *membership*—H. H. Lewis; *entertainment*—S. A. Durbin; *technical advisory*—S. C. McCann; *hospitality and welfare*—R. P. Campbell; *public relations*—H. E. Degler; *student branch relations*—W. K. Dyer; *news letter*—R. D. Hotchkiss.

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

• **NEBRASKA**—June 17, 1949. This meeting, taking place at Manawa Country Club, Council Bluffs, Iowa, was an outing and dinner dance for members, guests and the wives. Results of the election of officers were announced as follows: *president*—C. A. Carter; *vice president*—G. W. Colburn; *secretary*—K. E. Martin; *treasurer*—S. W. Black.

There were no other reports. Attendance 66. Attendance ratio 0.40.

• **NORTH TEXAS**—July 18, 1949. The July meeting was a social one, held as a western party at Wylie's Dude Ranch about 18 miles from Dallas. Well over 200 persons were there to enjoy some fine chuck wagon grub.

Joe Lewis, square dance caller, and his musicians put on a good show trying to teach the "Loggerheads" how to square dance. Chapter President G. A. Linskie received an "automatic lawn mower" in the form of a goat. Despite complaints to mapmaker E. T. Gessell, everyone who started out for Wylie's arrived there, or have been accounted for since. Attendance 218. Attendance ratio 0.80.

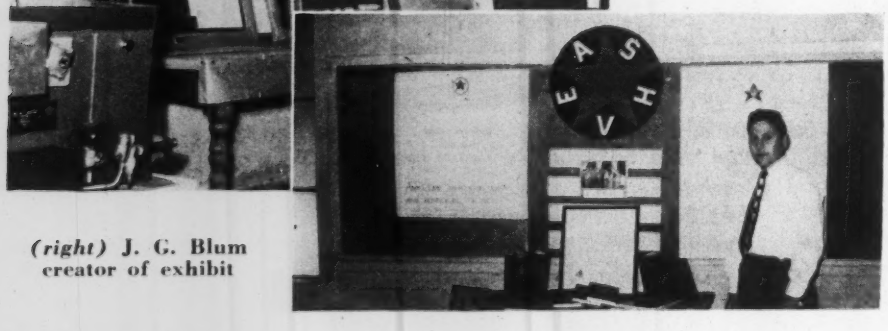
• **SOUTHWEST TEXAS**—July 28, 1949. Contrasts between the British and United States heating and fuel systems were brought out by W. R. Woolrich, dean of the Department of Engineering, University of Texas, Austin, Tex., speaking before the chapter in Austin.

Dean Woolrich pointed out the different steam boiler designs popularly used are at considerable variance from those used in the United States. For domestic heating the fireplace is popular. Other heating devices are normally built into a wall to conserve floor space. Heating equipment must have the approval of the Board of Trade before it may be sold. During the war, electric heating was popular, Dean Woolrich said.

Air conditioning is used almost entirely for dust and odor control and to keep merchandise in saleable condition. Cooling towers are made of brick and not of wood or metal as we know them. Dean Woolrich stated, however, that research in England is far advanced in farm mechanization, chemical weed control and highway construction.

Arrangement of the September meeting in Corpus Christi, Tex., was placed in the hands of R. W. Barnes. Mr. Pawkett commented on the possible program for the all-day meeting on October 11, 1949. Attendance 13. Attendance ratio 0.39.

(left) **N. P. Oldson at Open House**



(right) **J. G. Blum creator of exhibit**

STUDENTS HOLD OPEN HOUSE AT TEXAS A & M

An exhibit depicting the aims, activities and functions of the Society was staged by the Texas A & M Student Branch during the college's recent Open House Day, which attracted 700 visitors.

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Engineering with all its phases was featured during the event. The heating and ventilating field was represented by the ASHVE Student Branch, with R. S. Segall as chairman. Shift foremen during the exhibit were N. P. Oldson, C. V. Brown, J. V. Perry, Jr., and W. A. Byars, Jr.

The exhibit describing the Society's role was created by J. G. Blum.

SIX COLLEGES COOPERATING ON FUNDAMENTAL RESEARCH

Six cooperative projects were recently approved for a one-year period by the ASHVE Committee on Research headed by L. N. Hunter, Johnstown, Pa. Under contracts signed with six colleges and universities, the Society is making a grant of funds to each institution which in turn utilizes its own laboratory facilities for research. A Society technical advisory committee assists the university faculty in the cooperative program.

The institutions holding cooperative contracts with ASHVE are as follows: College of Medicine, University of Illinois, Chicago, Ill.; Case Institute of Technology, Cleveland, Ohio; Kansas State College, Manhattan, Kans.; Michigan State College, East Lansing, Mich.; Cornell University, Ithaca, N. Y.; and Columbia University, New York, N. Y.

At the University of Illinois, Dr. Robert W. Keeton, head of the department of medicine, will continue studies on whether there is any shock upon human beings entering or leaving a cooled space from a hot and humid atmosphere.

At Kansas State College, Prof. Linn Helander, head of the department of mechanical engineering, will be in charge of the research on heated air jets relating to industrial ventilation.

Prof. G. L. Tuve, a past president of the Society and head of the mechanical engineering department at Case Institute of Technology, is supervising studies on air flow through various outlets.

Air friction in rectangular ducts will be investigated at Michigan State College under the direction of Prof. L. G. Miller, dean of engineering.

Prof. C. O. Mackey, of the Sibley College of Engineering of Cornell University, will continue his studies of the sol-air temperature concept —the combined effects of solar and sky radiation, solar absorptivity, temperature and air movement.

An electrical analogue method is being employed by Prof. Carl F. Kayan, executive officer of the department of mechanical engineering at Columbia University, to continue his investigation on the effect of idle pipes on the temperature field and the heat flow in a concrete slab.

Candidates for Membership

The Constitution of the Society, as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society or sent to the members in other approved manner as ordered by the Council. When the replies are received from references, the Candidate's application shall be submitted to and acted upon by the Committee on Admission and Advancement as soon as possible.

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 31 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by October 25, 1949, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Secretary immediately after election.

BARBER, R. T., Sales Engr., Jones, Inc., New Orleans, La. PROPOSERS: R. B. Guest, T. A. Stokes. SECONDERS: E. P. Weatherby, Jr., W. H. Grant, Jr.

BARRAN, A. T. W., Student, The Trane Co. of Canada, Ltd., Toronto, Ont., Canada. PROPOSERS: S. A. Jennings, J. L. Neilans. SECONDERS: D. A. Long, H. M. Treleaven.

BENEDICT, L. A., Engr.-Estimator, J. R. Baldwin Co., Seattle, Wash. PROPOSERS: J. L. Brainerd, R. H. Liniger. SECONDERS: P. B. Tack, D. F. Owens.

BERRIER, A. W., Sales, United States Radiator Corp., San Francisco, Calif. PROPOSERS: Clyde Wilson-Reid, Norman Brown. SECONDERS: J. S. Rose, Eric Roberts.

DUA, B. S., Managing Dir., Oriental Refrigeration & Engrg. Co., Ltd., Calcutta, India. PROPOSERS: J. M. Brown, S. R. Sarkar. SECONDERS: J. R. B. Mallik, B. B. Ghosh.

EISER, J. L., Sr. Partner, Eiser & Akers, Cons. Engrs., Baltimore, Md. PROPOSERS: E. L. Crosby, H. D. Glaser. SECONDERS: E. J. Morris, E. H. Taze.

FREDERICK, E. W., JR., Sales Promotion Engr., Chase Brass & Copper Co., San Francisco, Calif. PROPOSERS: Clyde Wilson-Reid, Norman Brown. SECONDERS: J. S. Rose, Eric Roberts.

GOMPF, A. M., Cons. Engr., Egli & Gompf, Inc., Baltimore, Md. PROPOSERS: R. E. Dressell, E. J. Morris. SECONDERS: W. G. Robertson, Jr., E. L. Crosby.

GREENE, V. H., JR., Sales, McKesson & Robbins, Inc., Oklahoma City, Okla. PROPOSERS: J. H. Spaan, Jr., W. M.

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HOPKINS, D. M., Cons. Engr., David M. Hopkins & Associates, Tacoma, Wash. PROPOSERS: C. I. Vinsonhaler, D. O. Mead. SECONDERS: C. A. Pangborn, D. H. Conkling.

HOULIHAN, T. F., Sales Engr., Johnson-Goodyer, Inc., New Haven, Conn. PROPOSERS: W. A. Johnson, E. T. Houlihan. SECONDERS: A. J. Mongillo, F. A. DeLucia.

JAMESON, E. M., JR., Field Engr., U. S. Air Conditioning Corp., Oklahoma City, Okla. PROPOSERS: D. R. Groth, H. S. Shafer. SECONDERS: J. H. Spaan, Jr., J. H. Carnahan.

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KOVAL, M. B., Managing Dir., M. B. Koval & Co. (Proprietary) Ltd., Cape Town, So. Africa. PROPOSERS: W. E. Fett*, H. J. Hausner*. SECONDERS: S. H. Yenny*, M. P. Langdoc*.

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LOWRY, W. L., Sales Engr., American Blower Corp., Chicago, Ill. PROPOSERS: E. K. Emerson, J. H. Clarke. SECONDERS: M. W. Bishop, J. F. Tobin.

MORGAN, A. W., Engr., Morgan Co. Engineering, Corpus Christi, Tex. PROPOSERS: L. S. Pawkett, A. J. Rummel. SECONDERS: R. W. Barnes, G. R. Rhine.

ROBERTS, A. G., Chief Technical Repr., Messrs. Perfectair, Ltd., London, England. PROPOSERS: H. Dawson*, H. Bell*. SECONDERS: T. J. Terry*, L. Hill*.

RUMLEY, G. G., Pres., Dallas Rock Wool & Appliance Co., Dallas, Tex. PROPOSERS: T. H. Anspacher, H. G. Clark, Jr. SECONDERS: D. L. Echols, J. P. Ashcraft.

TENNANT, E. M., Mgr., American Air Conditioning & Engineering Co., Detroit, Mich. (*Reinstatement and Advancement*). PROPOSERS: H. C. Hoffmann, W. A. Brown. SECONDERS: G. H. Tuttle, E. T. Smith.

THORN, F. A., Engr., DeWitt C. Griffin & Associates, Seattle, Wash. PROPOSERS: D. H. Conkling, D. C. Griffin. SECONDERS: D. O. Mead, C. I. Vinsonhaler.

THRALL, M. N., Dist. Engr., General Electric Co., New York, N. Y. PROPOSERS: L. T. Brockbank, C. W. Brown. SECONDERS: F. H. Faust, W. F. R. Karsten*.

TUCK, W. L., Partner, Tuck & Son, Detroit, Mich. PROPOSERS: Ernest Sanger, E. J. Anderson. SECONDERS: G. J. Andrew, H. W. Snyder.

TUTT, D. J., Vice Pres. & Gen. Mgr., Gulf-York, Inc., New Orleans, La. PROPOSERS: J. S. Burke, J. O. Crary. SECONDERS: L. V. Busenlener, C. V. Bankston.

*Non-Member

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The following candidates are students from the colleges and universities listed as follows:

Louisiana Polytechnic Institute, Ruston, La. PROPOSERS: A. E. Williams, J. R. Williams. SECONDERS: J. F. Yoder, J. H. Traylor, Jr.

WINK, J. D., JR.

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University of Colorado, Boulder, Colo. PROPOSERS: B. H. Spurlock, Jr., B. T. Arnberg*. SECONDERS: R. B. Stewart*, D. W. Orendorff*.

FREEMAN, C. E., JR.

University of Detroit, Detroit, Mich. PROPOSERS: J. J. Uicker, L. M. Blanchette. SECONDERS: S. H. Kosinski, A. F. Lewis.

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JONES, C. N., Sales Engr., Outside Venetian Blind Co., Dallas, Tex. PROPOSERS: Herman Blum, H. J. Martyn, Jr. SECONDERS: E. J. Stern, M. J. Murray.

NOTTBERG, HENRY, JR., Secy., U. S. Engineering Co., Kansas City, Mo. PROPOSERS: D. M. Allen, Carl Clegg. SECONDERS: P. C. Leffel, C. L. McMichael.

PAWKETT, L. S., Pres., L. S. Pawkett & Co., San Antonio, Tex. PROPOSERS: R. W. Barnes, I. W. Wilke. SECONDERS: G. R. Rhine, L. H. Hornor, Jr.

SCOTT, R. M., Owner, Roy M. Scott, San Francisco, Calif. PROPOSERS: H. V. Hickman, P. R. Babcock. SECONDERS: R. C. Cushing, K. F. Baldwin, Jr.

ASHVE REPRESENTATIVES AID IN PIPING CODE WORK

The Sectional Committee on the Code for Pressure Piping, *ASA*-B31, has been reorganized under the chairmanship of F. S. G. Williams, with Sabin Crocker as vice chairman, and L. W. Benoit as secretary. All are from New York, N. Y.

The present Code for Pressure Piping, with Supplement No. 2, as approved by the American Standards Association on April 7, 1947, is up for consideration and revision. A. C. Buensod, member of ASHVE and *ASRE*, is chairman of the subcommittee, section 5, Refrigeration Piping. Mr. Buensod is organizing the subcommittee of approximately 10 voting members and is obtaining representatives from organizations interested in the Code.

The scheme of reorganization of the Sectional Committee also permits corresponding members, who may sit in on all meetings. Such members do not have a vote but by correspondence can submit comments and advice.

The ASHVE Standards Committee has appointed S. I. Rottmayer of S. R. Lewis & Associates, Chicago, as subcommittee representative.

PERSONALS

Allison F. H. Scott is now southwestern regional manager for the Stewart-Warner Corp., Chicago. Mr. Scott will be in charge of domestic heating equipment sales at Dallas, Tex. He was formerly with the FHA in Washington, D. C.

Parker D. Shepperd is now manager of the Cleveland branch of Johnson Service Co. He was formerly senior sales engineer in Detroit, and has belonged to the Delta, Cincinnati and Michigan Chapters of the Society.

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F. Paul Anderson Award: Lester T. Avery, *Chairman;* Homer Addams, F. E. Giesecke, S. R. Lewis, H. C. Murphy.

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Air Distribution: Ernest Szekely, *Chairman;* N. E. Berry, H. F. Brinen, R. M. Conner, S. H. Downs, Linn Helander, F. B. Holgate, F. J. Kurth*, J. N. Livermore, R. D. Madison*, G. E. McElroy, L. G. Miller, D. W. Nelson, W. A. Pownall, G. B. Priester, C. H. Randolph, T. H. Troller, G. L. Tuve.

Air Sterilization: W. F. Wells, *Chairman;* W. T. Anderson, Jr., L. J. Buttolph, C. W. Flood, Jr., Leonard Greenburg, M.D., B. H. Jennings, E. R. Queer*, Mildred W. Wells, M.D., C.-E. A. Winslow.

Combustion: R. K. Thulman, *Chairman;* P. R. Achenbach, J. F. Barkley, L. L. Connell, R. C. Cross*, R. B. Engdahl, J. C. Hauf, Jr., R. C. Johnson, W. B. Kirk, S. J. Levine, J. W. Miller, W. M. Myler, Jr., K. O. Schlentner, G. Schueder, E. T. Selig, Jr., T. H. Smoot, E. C. Webb.

Cooling Load: W. E. Zieber*, *Chairman;* R. D. Blum, W. F. Friend, R. H. Heilman, H. W. Heisterkamp, R. C. Jordan, C. F. Kayan, J. N. Livermore, R. H. Lock, C. O. Mackey, J. P. Stewart.

Corrosion: L. F. Collins, *Chairman;* A. S. Gates, Jr., A. E. Griffin, E. W. Guernsey, H. A. Pray, F. N. Speller, T. H. Urdahl*.

Heat Flow Through Glass: R. A. Miller, *Chairman;* A. B. Algren*, W. J. Arner, A. H. Baker, F. L. Bishop, Jr., R. D. Blum, G. W. Day, J. E. Frazier, J. S. Herbert, E. H. Hobbie, C. O. Mackey, F. W. Preston, W. C. Randall, C. A. Richardson, Vic Sanders, H. B. Vincent.

Heat Pump: R. C. Jordan, *Chairman;* E. R. Ambrose, R. D. Blum, C. F. Boester, C. W. Brown, W. F. Friend, M. C. Giannini*, C. F. Kayan, J. D. Kroeker, E. P. Palmatier, S. S. Sanford.

Heating Load: T. F. Rockwell, *Chairman;* R. A. Biggs, A. I. Brown, R. C. Cross*, R. S. Dill, W. S. Harris, J. M. Hartman, L. G. Miller, S. I. Rottmayer, M. W. Shears, G. H. Tuttle.

Human Calorimetry: G. L. Tuve, *Chairman;* E. F. DuBois, M.D., J. D. Hardy, M.D., E. R. Queer*, L. E. Seeley, C. P. Yaglou.

Industrial Ventilation: W. N. Witheridge, *Chairman;* A. D. Brandt, J. H. Clarke, W. C. L. Hemeon, W. O. Huebner, C. W. Johnson*, J. M. Kane, M. G. Kershaw, L. L. Lewis, G. E. McElroy, H. A. Mosher, B. F. Postman, K. E. Robinson, B. R. Small, W. M. Wallace, II, R. P. Warren, H. E. Ziel.

Insulation: E. R. Queer*, *Chairman;* R. E. Backstrom, C. B. Bradley, R. B. Crepps, M. W. Keyes, H. E. Lewis, H. E. Robinson, Vic Sanders, T. D. Stafford, L. V. Teesdale, R. K. Thulman, T. T. Tucker, P. M. Woodworth.

Odors: T. H. Urdahl*, *Chairman;* N. E. Berry, W. V. Consolazio, C. L. Fay, W. A. Grant*, E. P. Heckel, G. W. Meek, H. T. Porter, Amos Turk, W. N. Witheridge.

Panel Heating and Cooling: P. B. Gordon, *Chairman;* A. B. Algren*, J. W. James*, J. S. Locke, S. K. Smith.

Group A—Heat Distribution Within and Behind the Panel: A. B. Algren*, *Chairman;* R. A. Biggs, R. S. Dill, H. L. Flodin, F. E. Giesecke, W. S. Harris, C. F. Kayan, G. D. Lain, R. L. Maher, C. W. Meininger, D. L. Mills, C. W. Nessell, P. S. Park, S. I. Rottmayer, E. E. Scott, S. K. Smith, R. K. Thulman, S. M. VanKirk, W. J. Widmer, G. L. Wiggs.

Group B—Heat Transfer Between the Panel and the Space: J. W. James*, *Chairman;* C. M. Ashley, J. T. Bergen, C. F. Boester, Wharton Clay, Linn Helander, A. L. Jaros, H. A. Lockhart, W. E. Long, C. O. Mackey, R. A. Miller, G. W. Penney, G. G. Sward, J. M. van Nieukerken, H. E. Wheeler.

Group D—Controls: J. S. Locke, *Chairman;* H. W. Alyea, S. D. Browne, R. L. Campbell, C. M. Garner, P. B. Gordon, W. J. Hajek, A. J. Keating, W. H. Kliever, H. T. Kucera, P. F. Neess, J. K. M. Pryke, E. J. Ritchie, C. W. Signor, N. D. Skinner, A. S. Widdowfield.

Physiological Research: R. W. Keeton, M.D., *Chairman;* Thomas Bedford, A. R. Behnke, Capt., MC, USN, E. W. Brown, M.D., A. C. Burton, M.D., E. F. Dubois, M.D., A. P. Gagge, Lt. Col., MSC, USAF, F. K. Hick, M.D., J. W. James*, D. H. K. Lee, M.D., Charles Sheard, C.-E. A. Winslow.

Sensations of Comfort: C. S. Leopold, *Chairman;* Lester T. Avery, John Evereтts, Jr., Nathaniel Glickman, W. A. Grant, E. J. Rodee.

Sorbents: John Everetts, Jr., *Chairman;* G. C. F. Asker, I. W. Cotton*, F. C. Dehler, A. S. Gates, Jr., E. R. McLaughlin, J. C. Patterson, G. L. Simpson, F. J. Swaney.

Sound Control: T. A. Walters, *Chairman;* C. M. Ashley, P. H. Geiger, Sidney Gordon, F. B. Holgate, G. C. Kerr, M. W. Keyes, R. D. Madison*; T. H. Troller, George Wohlberg.

*Member of Committee on Research

OFFICERS OF LOCAL CHAPTERS AND STUDENT BRANCHES

(41 Chapters—9 Student Branches)

• ATLANTA: Organized 1937. Headquarters, Atlanta, Ga. Meets, First Friday. President, Leo Sudderth, Jr., 810 Bona Allen Bldg., Atlanta 3. Secretary, F. A. Player, 313 Techwood Dr., N. W., Atlanta.

• CENTRAL NEW YORK: Organized 1944. Headquarters, Syracuse, N. Y. President, V. S. Day, 300 S. Geddes St., Syracuse 1. Secretary, J. H. Carpenter, 3515 Midland Ave., Syracuse 7.

• CENTRAL OHIO: Organized 1944. Headquarters, Columbus, Ohio. Meets, Third Monday. PRESIDENT, E. A. Norman, Jr., 1150 Chesapeake Ave., Columbus 12. SECRETARY, R. S. Curl, 80 S. Third St., Columbus 15.

• CINCINNATI: Organized 1932. Headquarters, Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, K. B. Little, 832 Temple Bar Bldg., Cincinnati 2. SECRETARY, D. J. Wood, 659 E. Sixth St., Cincinnati.

• CONNECTICUT: Organized 1940. Headquarters, New Haven, Conn. Meets, Third Thursday. PRESIDENT, Winfield Roeder, 405 Temple St., New Haven. SECRETARY, T. L. Arnold, 26 Francis Ave., Hartford.

• DELTA: Organized 1939. Headquarters, New Orleans, La. Meets, Second Tuesday. PRESIDENT, R. B. Guest, 827-37 Dryades St., New Orleans 13. SECRETARY, Theodore Offner, 1000 S. Peters St., New Orleans.

• GOLDEN GATE: Organized 1937. Headquarters, San Francisco, Calif. Meets, First Thursday. President, H. V. Hickman, 1129 Folsom St., San Francisco 1. Secretary, R. C. Cushing, 1136 Howard St., San Francisco 3.

• ILLINOIS: Organized 1906. Headquarters, Chicago, Ill. Meets, Second Monday. PRESIDENT, J. S. Kearney, 1905 Greenleaf St., Evanston. SECRETARY, G. W. Bornquist, 629 W. Washington Blvd., Chicago 6.

• INDIANA: Organized 1943. Headquarters, Indianapolis, Ind. Meets, Fourth Friday. PRESIDENT, W. R. Fenstermaker, 937 Architects & Builders Bldg., Indianapolis 4. SECRETARY, F. C. Barton, 938 K of P Bldg., Indianapolis.

• IOWA: Organized 1940. Headquarters, Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, D. E. Wells, 304 Home Federal Bldg., Des Moines 9. SECRETARY, C. P. North, P.O. Box 833, Des Moines 4.

• KANSAS CITY: Organized 1917. Headquarters, Kansas City, Mo. Meets, First Monday. PRESIDENT, Henry Nottberg, Jr., 914 Campbell, Kansas City 6. SECRETARY, C. W. Schumacher, 1922 Grand Ave., Kansas City 9.

• MANITOBA: Organized 1935. Headquarters, Winnipeg, Man., Canada. Meets, Third Thursday. President, A. W. Moss, 268 Yale Ave., Winnipeg. Secretary, C. M. Fleming, 447 Main St., Winnipeg.

• MASSACHUSETTS: Organized 1912. Headquarters, Boston, Mass. Meets, Third Tuesday. PRESIDENT, W. H. Shipp, 124 Lewis Rd., Belmont 78. SECRETARY, J. P. Licandro, 177 State St., Boston.

• MEMPHIS: Organized 1944. Headquarters, Memphis, Tenn. Meets, Third Monday. PRESIDENT, W. L. Wellford, Jr., 730 S. Third St., Memphis 2. SECRETARY, A. T. Bevil, 1521 Waverly Ave., Memphis 6.

• MICHIGAN: Organized 1916. Headquarters, Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, L. A. Burch, 5853 Hamilton Ave., Detroit 2. SECRETARY, J. H. Spurgeon, 5050 Joy Rd., Detroit 4.

• MINNESOTA: Organized 1918. Headquarters, Minneapolis, Minn. Meets, First Monday. PRESIDENT, R. C. Jordan, University of Minnesota, Minneapolis 14. SECRETARY, E. F. Snyder, Jr., 4324 Zenith Ave., N., Minneapolis 12.

• MONTREAL: Organized 1936. Headquarters, Montreal, Que., Canada. Meets, Third Monday. President, S. W. Salter, 3410 Trenholme Ave., Montreal. Secretary, J. G. Chenevert, 1010 St. Catherine St., W., Montreal.

• NEBRASKA: Organized 1940. Headquarters, Omaha, Neb. Meets, Second Tuesday. PRESIDENT, C. A. Carter, 3019 Grebe St., Omaha 12. SECRETARY, K. E. Martin, 203 Patterson Bldg., Omaha 2.

• NEW YORK: Organized 1911. Headquarters, New York, N. Y. Meets, Third Monday. President, H. S. Johnson, 39 Cortlandt St., New York 7. Secretary, Carl H. Flink, Room 3000, 51 Madison Ave., New York 10.

• NORTH CAROLINA: Organized 1939. Headquarters, Durham, N. C. Meets, Quarterly. President, DeParx Stimson, 121 Idlewilde Dr., Winston-Salem. Secretary, R. B. Crosland, Jr., 1001 S. Marshall St., Winston-Salem.

• NORTH TEXAS: Organized 1938. Headquarters, Dallas, Tex. Meets, Third Monday. PRESIDENT, G. A. Linskie, Buckner Blvd., Dallas 10. ACTING SECRETARY, R. G. Lyford, 2415 N. Pearl St., Dallas.

• NORTHEASTERN OKLAHOMA: Organized 1948. Headquarters, Tulsa, Okla. President, W. R. Lee, 303 Beacon Bldg., Tulsa 3. Secretary, R. F. Shoemaker, 1136 So. Peoria, Tulsa.

• NORTHERN OHIO: Organized 1916. Headquarters, Cleveland, Ohio. Meets, Second Monday. PRESIDENT, R. L. Byers, 1740 E. 12th St., Cleveland 14. SECRETARY, G. V. Parmelee, 94 Solon Rd., Chagrin Falls.

• OKLAHOMA: Organized 1935. Headquarters, Oklahoma City, Okla. Meets, Second Monday. President, H. S. Shafer, 400 Key Bldg., Oklahoma City 2. Secretary, R. E. Swan, 117 N.W. First St., Oklahoma City.

• ONTARIO: Organized 1922. Headquarters, Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, A. J. Strain, 474 Bathurst St., Toronto. SECRETARY, H. R. Roth, 57 Bloor St., W., Toronto, Ont.

• OREGON: Organized 1939. Headquarters, Portland, Ore. Meets, Thursday after First Tuesday. President, J. P. McDermott, 308 Dekum Bldg., Portland 4. Secretary, K. H. Hanson, 6317 S.E. 40th St., Portland.

• PACIFIC NORTHWEST: Organized 1928. Headquarters, Seattle, Wash. Meets, Second Tuesday. PRESIDENT, J. D. Sparks, 7331 W. Green Lake Way, Seattle 3. SECRETARY, W. B. Pride, 3228 37th Pl., Seattle 44.

• PHILADELPHIA: Organized 1916. Headquarters, Philadelphia, Pa. Meets, Second Thursday. President, F. H. Buzzard, 213-15 S. Broad St., Philadelphia 7. Secretary, C. F. Dietz, 3449 W. Indiana Ave., Philadelphia 32.

• PITTSBURGH: Organized 1919. Headquarters, Pittsburgh, Pa. Meets, Second Monday. PRESIDENT, H. J. Kirkendall, 291 Catalpa Pl., Pittsburgh 16. SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St., Pittsburgh 22.

• ROCKY MOUNTAIN: Organized 1944. Headquarters, Denver, Colo. Meets, First Wednesday. PRESIDENT, E. J. McEahern, 1146 Market, Denver 4. SECRETARY, N. H. Brickham, 2715 S. Humboldt, Denver.

• ST. LOUIS: Organized 1918. Headquarters, St. Louis, Mo. Meets, First Tuesday. PRESIDENT, W. A. Russell, 7918 Kingsbury Blvd., Clayton 5. SECRETARY, H. C. Sharp, 4060 W. Pine Blvd., St. Louis 8.

• SHREVEPORT: Organized 1948. Headquarters, Shreveport, La. Meets, Third Thursday. President, A. H. Otto, 1020 Market St., Shreveport. Secretary, S. W. Beaty, P.O. Box 1734, Shreveport.

• SOUTH TEXAS: Organized 1938. Headquarters, Houston, Tex. Meets, Third Friday. PRESIDENT, R. J. Salinger, 4510 Dewberry Lane, Houston 4. SECRETARY, G. J. Collins, P.O. Box 2463, Houston.

• SOUTHERN CALIFORNIA: Organized 1930. Headquarters, Los Angeles, Calif. Meets, Third Wednesday. PRESIDENT, J. L. Blake, 1700 S. Bedford St., Los Angeles 35. SECRETARY, M. C. Greiner, 1559 Club View Dr., Los Angeles 24.

• SOUTHWEST TEXAS: Organized 1946. Headquarters, San Antonio, Tex. Meets, Second Tuesday. President, G. R. Rhine, 1208 Alamo National Bldg., San Antonio. Secretary, I. W. Wilke, P.O. Box 1134, Austin 3.

• UTAH: Organized 1944. Headquarters, Salt Lake City, Utah. Meets, First Wednesday. President, C. E. Ferguson, 838 E. Garfield Ave., Salt Lake City. Secretary, A. R. Curtis, 2211 Highland Dr., Salt Lake City.

• VIRGINIA: Organized 1946. Headquarters, Norfolk, Va. President, J. E. White, 7607 Gloucester Ave., Norfolk 5. Secretary, D. E. Phillips, P.O. Box 674, Newport News.

• WASHINGTON, D. C.: Organized 1938. Headquarters, Washington, D. C. Meets, Second Wednesday. President, P. R. Achenbach, Connecticut & Van Ness St., Washington, D. C. Secretary, J. G. Muirheid, 2013 New Hampshire Ave., N. W., Washington 9.

• WESTERN MICHIGAN: Organized 1931. Headquarters, Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, J. A. Alexander, P. O. Box 132, Station C, Grand Rapids. SECRETARY, L. A. Calcaterra, 1136-42 Plainfield Ave. N.E., Grand Rapids.

• WESTERN NEW YORK: Organized 1919. Headquarters, Buffalo, N. Y. Meets, Second Monday. PRESIDENT, F. J. Weber, 443 Delaware Ave., Buffalo 2. SECRETARY, J. M. Quackenbush, 610 Linwood Ave., Buffalo.

• WISCONSIN: Organized 1922. Headquarters, Milwaukee, Wis. Meets, Third Monday. PRESIDENT, B. M. Kluge, 1817 So. 66th St., Milwaukee 14. SECRETARY, J. A. Lofte, 9121 W. Hawthorne Ave., Milwaukee 13.

Student Branches

• COLLEGE OF CITY OF NEW YORK: Organized 1949. Headquarters, New York, N. Y. PRESIDENT, Norman Moskowitz, 153 Clinton Ave., Brooklyn 5. SECRETARY, Seymour Oestreicher, 2009 Bryant Ave., New York 60.

• LOUISIANA POLYTECHNIC INSTITUTE: Organized 1949. Headquarters, Ruston, La. PRESIDENT, J. C. Cox, 417 W. Mississippi, Ruston. SECRETARY, H. D. Hayes, Box 409 Tech Station, Ruston.

• NORTH CAROLINA STATE COLLEGE: Organized 1948. Headquarters, Raleigh, N. C. PRESIDENT, J. J. Andrews, 710 Harvey St., Raleigh. SECRETARY, E. A. Stroupe, Jr., 416 Halifax St., Raleigh.

• OREGON STATE COLLEGE: Organized 1949. Headquarters, Corvallis, Ore. PRESIDENT, M. B. Larson, 2311 N. E. Hancock, Portland 12. SECRETARY, Helen P. Lankow, 1349 S. E. Birch St., Portland 14.

• PURDUE UNIVERSITY: Organized 1948. Headquarters, W. Lafayette, Ind. Chairman, M. E. Naftzger, FPHA 228-2, State St., W. Lafayette. Secretary, C. M. Wade, The Maples Trailer Camp, Lafayette.

• TEXAS A. & M. COLLEGE: Organized 1946. Headquarters, College Station, Tex. Meets, Third Thursday. President, C. V. Brown, Mech. Engrg. Dept., Texas A. & M. College, College Station. Secretary, R. N. Hughes, 109 W. 8th St., Quanah, Tex.

• UNIVERSITY OF DETROIT: Organized 1949. Headquarters, Detroit, Mich. Meets First Tuesday. PRESIDENT, L. M. Blanchette, 2245 Holcomb, Detroit 14. SECRETARY, S. H. Kosinski, 4439-30th, Detroit 10.

• UNIVERSITY OF KANSAS: Organized 1949. Headquarters, Lawrence, Kans. President, V. N. Elder, 643 Tennessee, Lawrence. Secretary, L. H. Noll, 1235 New York St., Lawrence.

• UNIVERSITY OF TEXAS: Organized 1949. Headquarters, Austin, Tex. President, K. A. Martino, 1909 Whitis, Austin. Secretary, D. P. Collins, 1915 Nueces St., Austin.

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EQUIPMENT DEVELOPMENTS

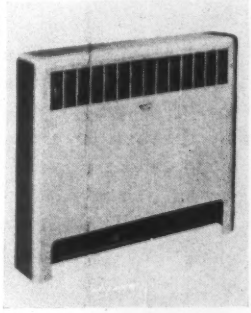
For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1949 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk equipment and manufacturer not listed.

Convector-Radiator Line Has Many Features

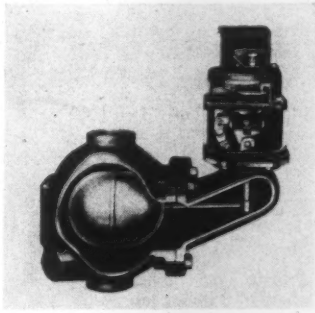
No. 4156—Young Radiator Co., Racine, Wis., is offering a new line of convector-radiators for use in homes, offices, apartments, schools, hospitals, institutions, and public buildings.

Shown here is the free standing type unit, which also may be installed as a semi-recessed model. This is one of six standardized types available from stock for any hot water or two pipe steam system. Other models in the line are the wall hung (sloping top), partially recessed, fully recessed, bathroom, and institutional units.

Features are said to include packaged units for protection, quick handling, and easy identification; standardized models available from stock; ratings in accordance with the provisions of Commercial Standard CS140-47; over-size grilles for maximum heat delivery; easy-to-remove panels for quick cleanability; top and bottom header connections for simplified piping; nonferrous, tube-and-fin core; improved heating element supports; and modern cabinets.



Convector



Low Water Cutoff

Low Water Cutoff Used on Hot Water Heating Boilers

No. 4157—A new low water fuel cutoff (No. 63) for automatically fired boilers carrying up to 50 psi pressure is available from McDonnell & Miller, Inc., 1316 Wrigley Bldg., Chicago 11.

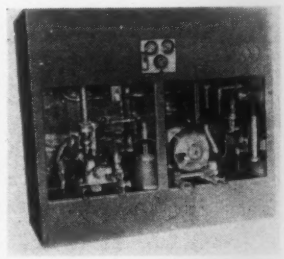
According to the company, it was developed in keeping with a growing trend toward the application of a device to stop the burner in the event of low water in a hot water boiler, a condition which might result from leaks in the system, inoperative primary controls, prolonged opening of a relief valve in an emergency, etc. The unit is also recommended for use with automatically fired steam boilers in the range of pressures from 20 to 50 psi.

All working parts are isolated from the heat of the float chamber. The sylphon bellows is up out of the water and all other working parts are of noncorrosive materials.

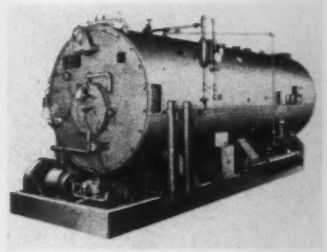
Offers Liquid Cooler as Packaged Unit

No. 4158—To provide accurate control of chilled liquids, Doyle & Roth Mfg. Co., foot of 23rd St., Brooklyn 32, has introduced a packaged unit which includes a "Freon" compressor, motor and starter, shell and tube liquid cooler, condenser, and necessary controls. The cooler and condenser are designed to meet individual requirements of the application. The arrangement of furnace and tubes is said to provide a high rate of heat transfer, low exit gas temperature, and to speed up water circulation.

Completely shop assembled, the unit is available in a range of sizes from 5 to 100 tons.



Liquid Cooler



Steam Generator

New Unit Generates Steam Quickly

No. 4159—Ames Iron Works, Oswego, New York, has developed a new 400 hp "Amesteam" packaged steam generator which is said to be automatic and extremely economical, rugged, compact, simple in design, and easy to maintain. It is built for pressures from 15 to 200 psi, for operation with oil or gas, or in areas where both oil and gas are available or seasonal costs vary, for use with oil-gas combination burners.

The new unit is furnished complete, ready for installation. When connected to steam, water, fuel and electric lines, breeching or stack, it is ready for operation. According to the company, commercially dry steam at operating pressure can be produced from a cold start in 20 to 30 min.

FOR YOUR CONVENIENCE

Heating, Piping & Air Conditioning **[10-49]**
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature

(Circle each number in which you are interested)

4156 4157 4158 4159 4160 4161 4162 4163 4164 4165
4166 4167 4168 4169 4170 4171 4172 4173 4174 4175
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7447 7448 7449 7450 7451 7452 7453 7454 7455 7456
7457 7458 7459 7460 7461 7462 7463

Name..... **Title**.....

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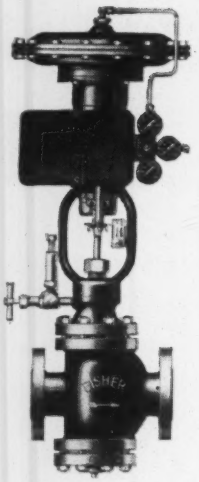
Controller Designed to Insure Correct Valve Position



No. 4160 — Fisher Governor Co., Marshalltown, Iowa, is now in production on its new Series 3500 valve controller, the "Positrol".

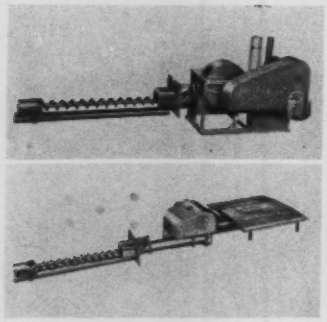
It is a force balance type controller designed to insure correct position of the valve in accordance with the dictates of the controlling instrument. Available with or without a bypass, it may be used as a remote position indicator and is said to be very simple in design, consisting of a few levers, a bellows unit, and a spring. Valve travel is adjustable between ¼ in and 3 in.

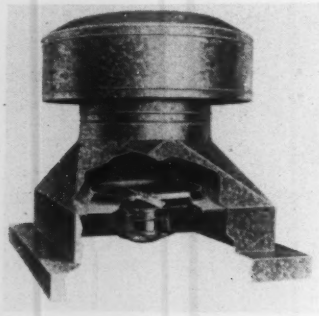
Industrial Stokers Feed Coal Directly From Bunker to Boiler

No. 4161—Among products recently developed by Iron Fireman Mfg. Co., 3170 W. 106th St., Cleveland 11, are two new lines of industrial "Coal-Flow" stokers for feeding coal directly from the storage bunker to the boiler. These units are equipped with infinitely variable transmissions and fully synchronized coal and air regulators.

The CF series, in capacities from approximately 500 to 1100 lb of coal per hr, is of the underfeed type and utilizes a worm conveyor. It is said to provide unusual flexibility of application and important fuel and labor saving advantages. The new PCF series "Poweram" unit is designed to deliver coal to the retort in a loose unpacked condition and to distribute it over the grates by a reciprocating ram and wedge blocks in the retort. Capacities are from approximately 500 to 1600 lb per hr.

The new series 401 stoker, for handling 750 to 4000 lb per hr, is of the pneumatic spreader type and is said to perform a number of separate functions "not usually associated with the term stoker." The complete system is designed to meter coal from the bunker, dry and preheat it using hot furnace gases, convey the fuel from bunker to furnace and distribute it uniformly over the grates, burn the coal under positive control, provide automatic, independent zone control of air and coal, and provide pneumatic cinder return.





Left above, coal metering and preheating assembly of spreader stoker; *below*, underfeed stoker; *right*, roof ventilator

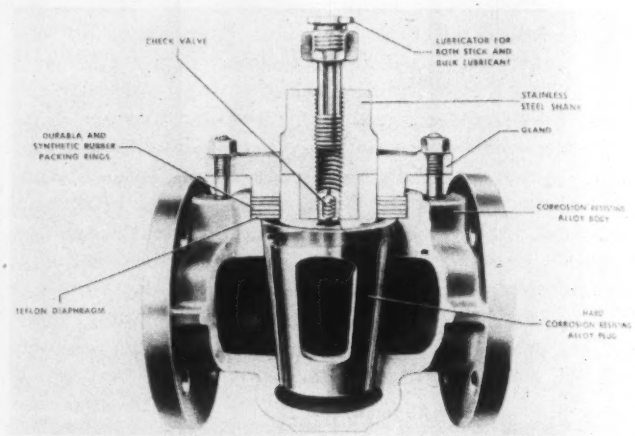
Combination Damper, Air Guide Features Roof Ventilator

No. 4162—Swartwout Co., 18511 Euclid Ave., Cleveland 12, has made an addition to its line of roof ventilators; a new round stationary type for general ventilation and miscellaneous "hot spots" of industrial and commercial buildings. Embodying new design features which are said to assure high efficiency, it is known as the "Valvent" and is made in five throat sizes, 12, 18, 24, 30 and 36 in.

A unique feature is said to be the combination damper and inverted cone air guide which is designed to guide outgoing air with minimum friction and permit any degree of opening desired, or tight closed. While standard construction is of galvanized steel, it can be made in other metals to meet special conditions and is offered as either a gravity ventilator or a powered unit, the latter form offering capacities from 630 to 25,700 cfm.

Plug Valve Resists Corrosion

No. 4163—The "Durco" type A valve is a top lubricated plug valve for general chemical service at medium pressures. According to the manufacturer, Duriron Co., Inc., Dayton 1, Ohio, it combines a body of corrosion resisting ductile alloy with a hard corrosion resisting plug.



The packing is said to be of sufficient resilience so the plug can be freed easily by lubricant pressure, at the same time being firm enough to maintain proper plug position. The "Teflon" diaphragm at the bottom of the stuffing box is designed to provide a highly corrosion resistant anti-friction seal. The body and gland are furnished in "Durimet 20," "Chlorimet 2 or 3" and other corrosion resisting alloys. The gland studs and plug shank are of stainless steel, and the lower part of the plug, in corrosive service, is of a hard alloy, such as "Duriron" or "Durichlor."

Simplifies Control of Heating, Air Conditioning Systems

No. 4164**—The "Magic Dial" master control system offered by Midwest Automatic Control Co., 510 Third St., Des Moines, Iowa, is designed to simplify and standardize the controls on heating, ventilating, and air conditioning systems.

The master control cabinet contains a rotary switch which is set to one of four positions—off, fan only, cooling, or heating. All other controls and instruments in the system are said to click into proper position automatically, and a wide variety of instruments can be controlled from the master cabinet.

Installation and servicing are simplified by the use of standardized instruments and a new numbered wire. Every inch of wire is imprinted with the same number as the terminals to be connected by that wire, and the master cabinet terminals are numbered to correspond to each of the other 13 instruments in the system.

THERE IS JUST ONE WAY

TO SAVE MONEY ON AIR FILTERS

USE THE FILTER THAT IS SCIENTIFICALLY MADE

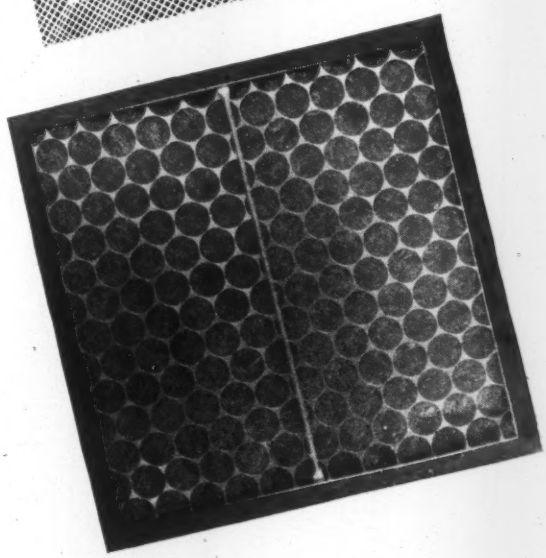
TO CATCH AND HOLD MORE DIRT

GLASFLOSS the glass fibre air filter for ALL forced Air Heating, Ventilating and Air Conditioning Systems.

Glasfloss Air Filters are made of incredibly fine glass fibres; fibres that are finer than human hair. They are formed into a light, fluffy mass with a maze of air passages.

This characteristic permits maximum penetration of dirt particles, while allowing free passage of air at normal velocities.

That is why Glasfloss Air Filters have a longer life cycle,—with efficiencies maintained until every tiny fibre in the element has trapped its share of dirt.



Once you see the light, fluffy texture of the Glasfloss filter element, you will know why Glasfloss Filters last longer, hold more dirt. We'll be glad to send a sample filter for your examination.

DISTRIBUTORS—Some territories are still open. Let us send you samples, descriptive literature and full information.

THE *Glasfloss* CORPORATION
COMMERCE BUILDING • NEW YORK 17, NEW YORK

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Whisper Quiet Model

UNIT HEATERS

Two Popular Models Available

WHISPER QUIET MODEL—For installations requiring quiet operation. More Head Room —Compact Design and More Heat From Gas Burned. A. G. A. approved for natural, manufactured, mixed or LP gases. Fully equipped with Automatic Controls.

HURRICANE MODEL—For Industrial Installations. This model is also compact in design, offering more Head Room and More Heat from Gas Burned. Will heat 40′ x 80′ space. A. G. A. approved for natural, manufactured, mixed or LP gases. Automatic Controls.

100,000 Btu/hr.

Both Models finished in Toast Tan Crinkle Enamel Baked on. Adjustable Louvers.

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BURNERS
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HEATING and PIPING NEED

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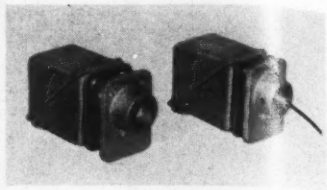
Provides Flame Failure Safeguards for Combination Gas-Oil Burners



No. 4165—Combustion Control Corp., 77 Broadway, Cambridge 42, Mass., has developed flame failure safeguards and programming systems for combination gas-oil burners.

With heavy oil as the main fuel and gas as the standby fuel, "Fireye" system FF-2 is used. This consists of an electronic rod for monitoring the gas pilot flame (preventing the main fuel valve from opening until flame is established), a photoelectric scanner which is used to turn off the entire system in the event of flame failure, and a programming control for starting the burner and programming the sequence of oil valve delay, post ignition timing, and priming period. When the system is converted to gas, the electronic rod monitors the continuous gas pilot and the programming control programs fuel and ignition systems.

With gas as the main fuel and light oil as the standby fuel, system FF-6 is used. With either gas or oil an electronic rod monitors the continuous gas pilot, providing (through the control unit) shutdown of main flame in the event of pilot flame failure. Monitoring operations on gas and light oil are identical.

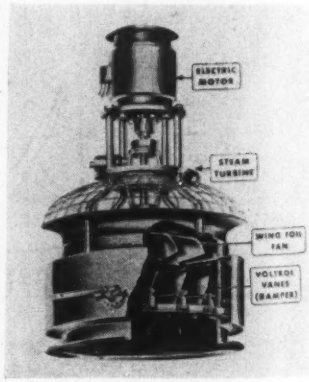
Flexible Coupling Has Chain Design

No. 4166—Morse Chain Co., Div. of Borg-Warner Corp., 7601 Central Ave., Detroit 8, is offering a completely new line of stock "Silent Chain" flexible couplings designated as series DSC.

The rugged, all steel construction is said to combine maximum power transmission capacity with minimum space requirement. Two sprockets are wrapped with a center guide chain. Disconnection is accomplished either by unwrapping the chain after removing the single connecting pin or by moving either sprocket endwise out of mesh with the chain.

Stock bores range from ½ to 2⅞ in. with capacities up to 119 hp at 2000 rpm.

Forced Draft Blower Has Dual Drive



No. 4167—L. J. Wing Mfg. Co., 14th St. and 7th Ave., New York 11, is now producing a forced draft blower incorporating a combined electric motor and steam turbine drive.

A change from one drive to another, says the company, can be made at will. The basic unit is the type R turbine blower with a totally enclosed, dust-proof motor connected to an extension of the turbine shaft. A choice of drive may be governed by consideration of heat balance, more economical operating costs, or emergencies affecting the source of power. Wide range of

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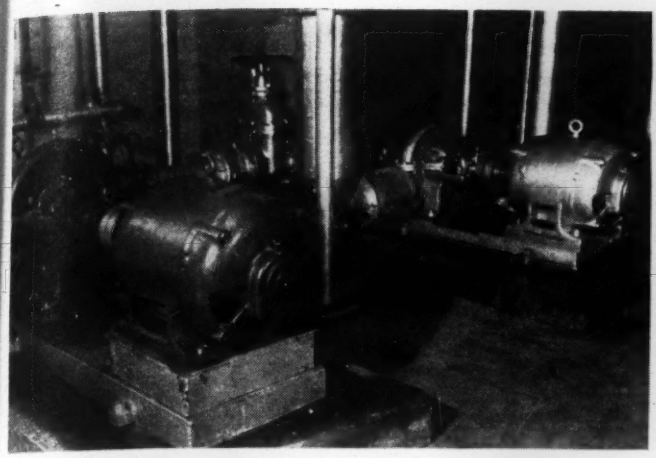
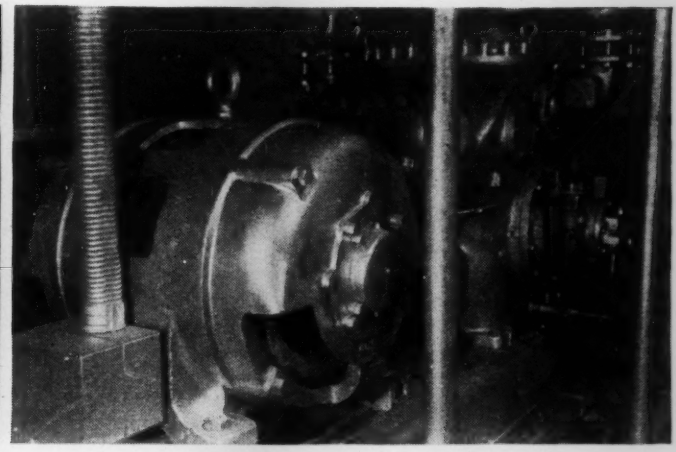


● Two Century 10 Horsepower Squirrel Cage three phase motors driving pumps — first is condenser water pump to dissipate heat; second pump circulates the cooled water.

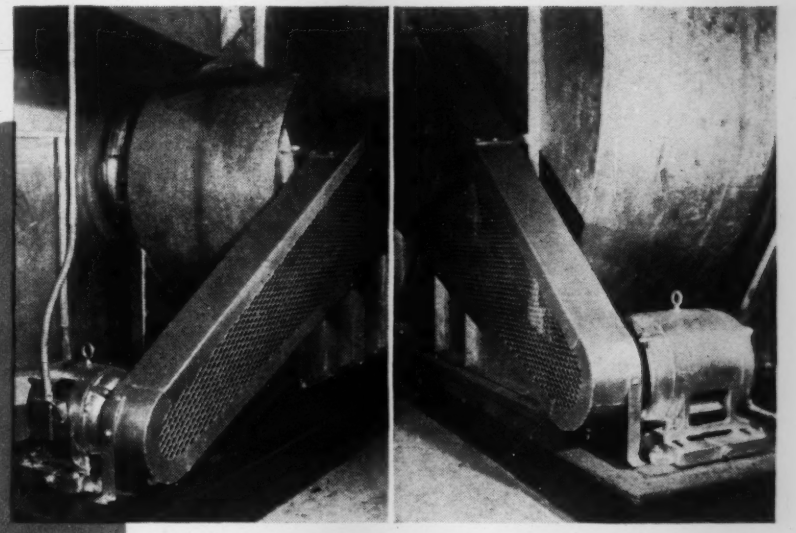


● 100 Horsepower Century Squirrel Cage motor driving a refrigeration compressor.

Thousands of Satisfied Users Specify

Century MOTORS -

For All the Equipment on Air Conditioning Installations



● One 30 Horsepower and one 5 Horsepower Squirrel Cage motor driving cool air supply fans.

-622

They Start Quietly and Operate Quietly

Century motors are built to match the requirements of the equipment they drive. Multi-speed squirrel cage motors provide flexibility—wound rotor motors provide a wide range of speed control. A complete line of constant speed squirrel cage motors handles all normal installations.

Century Splash Proof frames protect the motor against the hazards of dripping or splashing liquids, indoors or outdoors.

Totally enclosed fan cooled frames furnish protection against destructive dirt that packs.

For atmospheres containing explosive gases and dusts, explosion proof frames are available.

Century builds a wide range of types and kinds of electric motors, in sizes from 1/6 to 400 horsepower, for operation on single phase, polyphase and direct current.

Specify Century motors for all your electric power requirements.

Century C MOTORS

Popular types and standard ratings are generally available from factory and branch office stocks.

CENTURY ELECTRIC COMPANY

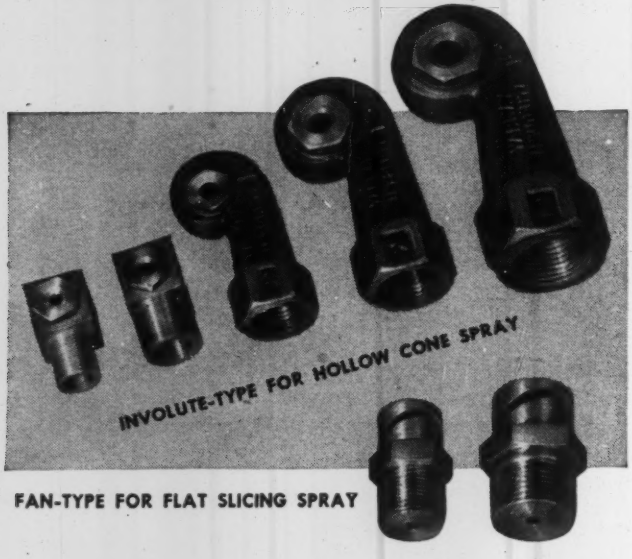
1806 Pine Street • St. Louis 3, Mo.

Offices and Stock Points in Principal Cities

for • SPRAYING
• WASHING
• RINSING
• COOLING
• AIR CONDITIONING

YARWAY

SPRAY NOZZLES



FAN-TYPE FOR FLAT SLICING SPRAY

Get the most out of your Spraying Equipment with minimum power . . . with efficient spraying.

Use Yarway Nozzles. No internal vanes or other restrictions to clog or hinder flow. Two types—Yarway Involute-type producing a fine hollow spray with minimum energy loss, and Yarway Fan-type producing a flat fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Cast or machined from solid bar stock.

Thousands in use. Write for Bulletin N-616.

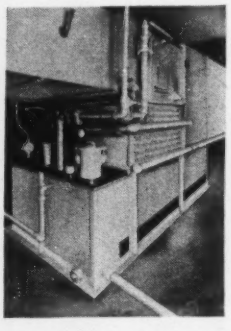
YARNALL-WARING COMPANY
107 Mermaid Avenue Philadelphia 18, Pa.

control is said to be available with both drives. Throttling gives speed control of the turbine and "Voltrol" vanes are used to permit capacity regulation for the motor drive. Automatic operation of both drives may be arranged in connection with a combustion control system. Shown here is the vertical unit which may be adapted to horizontal discharge by adding supporting feet.

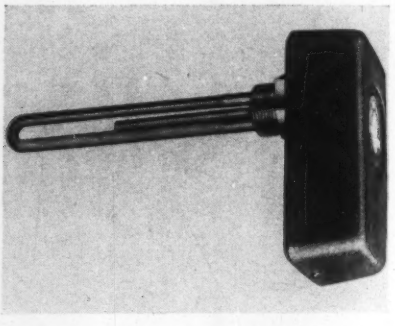
Eliminates Frost Formation on Low Temperature Coils

No. 4168—Frost condensation on low temperature heat exchange coils is said to be completely eliminated in a system recently developed by the Kathabar Div., Surface Combustion Corp., Toledo 1. The system is designed to permanently eliminate defrosting such coils and is said to have been tested at temperatures as low as —100 F. An adaptation of the "Kathabar" humidity control system, its operation is automatic and continuous.

An absorbent solution, composed largely of lithium chloride, is continually sprayed over the cold metal of the heat exchanger. This solution absorbs condensed moisture and drips down into a sump, after which some of it is passed through a regenerator which extracts moisture from the solution so that it will be able to absorb more on the next cycle. The solution, says the company, also has a slightly antiseptic effect on the air passing through it and removes dust and odors, while leaving no odor of its own in the air. A further advantage is the fact that air need not be cooled to the dew point corresponding to the moisture content required.



Frost Eliminator



Electric Water Heater Unit

Electric Unit Converts Standard Hot Water Tanks

No. 4169—A new series of "Chromalox" screw-in type electric water heater units with built-in thermostatic control has been announced by Edwin L. Wiegand Co., 7610 Thomas Blvd., Pittsburgh 8.

The heaters are designed for conversion of standard fuel fired hot water tanks to electricity and are said to be suitable for commercial and industrial purposes which require limited amounts of convenient hot water.

The heating element is a copper sheathed, enclosed type tubular heater brazed into a 1 in. red brass screw plug with a sealed brass well for the sensitive thermostat bulb. The thermostat, with removable housing, is mounted directly on the screw plug, and may be set to control water temperature between 100 and 170 F. The well is located so as to be in contact with the element for protection if the water level should drop below the element.

The new series, identified as type ARTM, is available for 118 or 236 volt service with wattages of 750, 1000, 1250, and 1500.

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Designed to Meet Every Space Heating Need

Pictured above are three good reasons for the ever-increasing preference for *Airtherm Unit Heaters*. Airtherm offers you Horizontal and Vertical propeller fan types for all commercial and industrial installations plus the Centrifugal fan type for handling large air volume, long heat throw and ductwork resistance.

The long life coils in Airtherm Unit Heaters have copper tubes and copper headers, brazed into an integral heat transfer unit. For outstanding performance and complete satisfaction, use AIRTHERM UNIT HEATERS. Try them on your next job!

For Heating Satisfaction . . . Think First of **AIRTHERM**

Oil or Gas Direct Fired Heaters | Horizontal Type Unit Heaters | Vertical Type Unit Heaters | Centrifugal Fan Type Unit Heaters | Convectors

AIRTHERM MANUFACTURING COMPANY

711 South Spring Avenue, St. Louis 10, Missouri

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REGULATING
VALVES

Want to install automatic regulating valves and know they're right . . . now and in the future . . . ? For trouble-free operation that makes your good job better, specify and make sure you get KLIPFEL Automatic Regulating Valves, designed to give more consistent service, longer and with less maintenance.

Bulletin No. 146 describes the many KLIPFEL Valves used in heating, piping and air conditioning. Write Dept. C-10. for your free copy.

Float Valves, Reducing Valves, Tank Thermostats and Back Pressure Valves
Sold through wholesalers everywhere.

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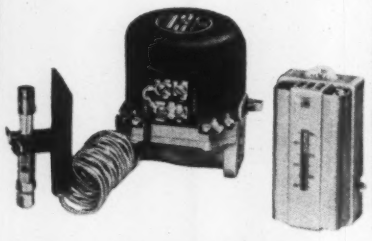
VALVES, INCORPORATED
DIVISION OF HAMILTON-THOMAS CORP.
HAMILTON, OHIO

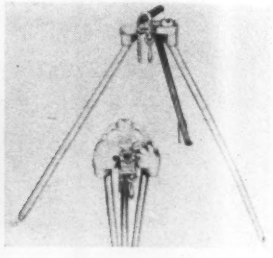
Gas Burner Control System Is Self Contained

No. 4170—A self contained automatic control system, the Y200 "Powerpile," for gas fired heating plants has been developed by Minneapolis-Honeywell Regulator Co., 2604 Fourth Ave., S., Minneapolis 8.

The system consists of three units; a thermopile consisting of 25 thermocouples which generate 400 to 500 millivolts, a heat leveling thermostat which contains a heat anticipator, and a diaphragm gas valve which employs a self contained polarized relay for added power to open and close the valve. The thermopile itself is encased in stainless steel and is attached to a pilot burner. The device acts as its own safety pilot.



Gas Burner Controls



Pipe Vise Stand

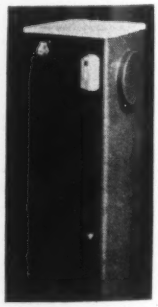
Pipe Vise Stand Made of Aluminum

No. 4171—According to J. H. Williams & Co., 400 Vulcan St., Buffalo 7, the weight of its new aluminum vise stand is approximately 50 percent that of iron or steel types, yet there has been no sacrifice in rigidity, strength, or performance.

The "heavily reinforced design" is said to prevent distortion under severe service. The base is made of aluminum alloy, and two pipe benders are provided, one for pipe up to ½ in., the other for pipe up to ¾ in. A recess for the oil and handy slots for tools are provided in addition to the V pipe support. Aluminum alloy legs may be folded and tied together with a permanently attached chain.

This new stand included the firm's No. 1 "Vulcan" pipe vise.

Dehumidifies Air in Storage Spaces, etc.



No. 4172**—The "Sahara" dehumidifier, said to be an efficient, low cost unit for combatting moisture problems in industry, is available from Niagara Industrial Corp., 20 Vesey St., New York 7. It is also said to be particularly suited to use in stock rooms, testing laboratories, paint drying rooms, storage vaults, and most confined storage areas where dampness is a problem.

About the size of a water cooler, it is plugged into any convenient electric outlet. An axial fan is used to draw air through calcium chloride crystals, and extracted moisture is drained off into a 2½ gal container. A humidistat may be used for automatic operation. Normal usage, says the company, entails recharging the calcium chloride hopper every month or so.

The capacity is 9½ qt per 24 hr extracted from air at 85 F and 85 percent relative humidity.

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Secondary Air Register Unit Designed for Rotary Oil Burners

No. 4173—Faber Engineering Co., Inc., Amber and Westmoreland Sts., Philadelphia 34, has developed an air register for the purpose of supplying secondary air for all types and sizes of rotary fuel oil burners.

Installation of the EKL unit is said to eliminate excavation and construction of an underneath pit for secondary air. According to the company, operation is controlled and centralized and air is introduced at the point of ignition so as to promote rapid combustion, short flame travel, maximum capacity, low excess air and high CO_2. Air louvers and the oil supply to the burner are linked and mechanically connected.

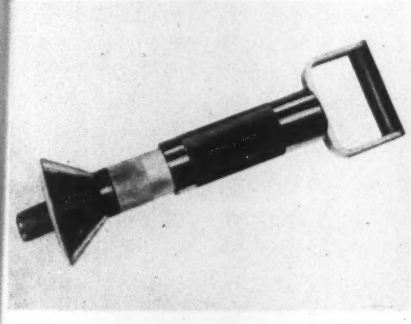
For combination gas and oil use, the company has developed a ring type gas burner especially adapted for use with this register. A change from gas to oil can be effected without delay or replacement of equipment.

Powdered Charge Drives Steel Studs or Pins

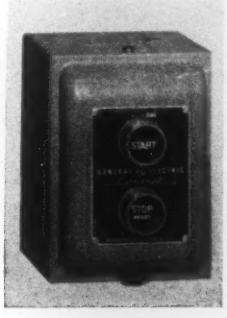
No. 4174—Stemco Corp., Rocky River, Cleveland, is now building an improved powder actuated fastening tool to replace the "Tempotool" formerly manufactured by this company.

The new system, which incorporates not only the fastening tool, but also a line of steel fasteners and powder charges, has been named "Ramset" fastening system. The tool is actuated by a powdered charge of several different strengths, which upon being exploded within the tool is said to force the steel studs or pins into steel, concrete, masonry, and other hard materials.

The device is designed to operate instantly, with only about 30 sec being required to prepare the tool and set the fastener into place. Applications are said to include the installation of electric equipment, conduit, automatic sprinklers, lighting, piping, heating, air conditioning, etc.



Fastening Tool



Motor Starter

Manually Operated A-C Starters Control Small Pumps, Blowers, etc.

No. 4175—A new line of manually operated starters for a-c motors up to 7½ hp is offered by General Electric Co.'s control divisions, Schenectady 5, N. Y. Introduced to complete its line of starters of this type, the new units are specially designed for use on equipment such as small pumps, blowers, and grinders.

Available immediately, they are furnished in both toggle and push-button types (shown here) in two, three and four pole forms, size 0 and 1. The toggle operated types in the above forms and sizes are also furnished, if desired, with cast iron enclosures for use in wet, dust laden, or hazardous locations.

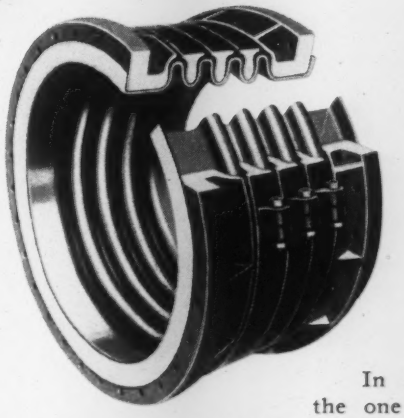
ANOTHER REASON WHY

Badger

IS FIRST IN

expansion joints

FLEXIBLE

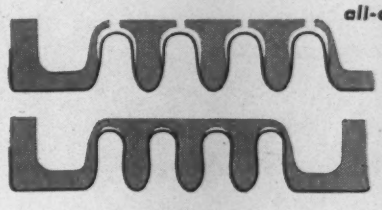


In flexibility — the one most important feature of *any* expansion joint — Badger stands first.

Fast response to the thrust produced by heat expansion means less wear, tear, and breakage on adjacent fittings and equipment. Just one reason why leaders in every field put their faith in Badger Packless Expansion Joints. Here are others:

- Packless . . . single tube construction provides pressure-tight joint without packing
- Compact . . . requires no more space than regular flanged fittings
- Special forming methods . . . no danger of structure-weakening stresses
- Controlled heat treating . . . to assure long life for flexing member
- Fabricated from stainless steel or alloys . . . joints withstand high temperature and corrosion
- Directed flexing rings . . . to equalize stresses *between* and *within* corrugations

These features are important in any pipe line job — you can get them *all* only by specifying Badger Expansion Joints.



EXCLUSIVE
***all-curve* corrugations equalize stresses**

COLD

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Only seconds with . . .

Ramset FASTENING SYSTEM

Thousands of RAMSET users (names on request) with routine and unusual fastening problems, have proved through experience the cost and time savings gained with the RAMSET FASTENING SYSTEM. Less than a minute—start to finish! That's all it takes, users find, to "RAMSET" pins or studs in concrete, steel, brick or other hard materials.

Just insert a RAMSET pin or stud (65 types and sizes available) and the self-contained power-charge into the sturdy, compact, self-contained RAMSET TOOL. Press the tool against the work—and RAM! It's SET! Instantly, tightly, easily—without muss or fuss.

RAMSET FASTENING SYSTEM can pay for itself on the first job. Any good workman can learn to be a *"Ramsetter"* in just 30 minutes. Call your local RAMSET representative immediately or write or wire us for details and the name of your nearest dealer.

STEMCO CORPORATION, Cleveland 16, Ohio

Do your fastening jobs
EASIER, QUICKER, BETTER with

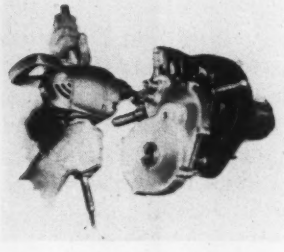
Ramset Fastening System

A feature is the bimetallic overload protection, which replaces the solder pot relay and is said to provide exceptionally accurate response to overloads. In addition, the starters are equipped with a wide range of heaters, all of which are used to follow closely the motor heating curve. Positive indication of overload trip is assured by the toggle or push button which assumes a neutral position when the relay trips. To prevent tampering, all starters in general purpose enclosures can be padlocked.

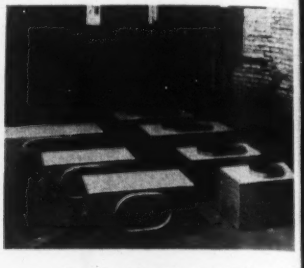
Portable Pipe Threader Handles up to 6 In. Pipe

No. 4176—"Porta-Drive," a new portable pipe threader, weighs only 14 lb and is designed to fit into the average tool box. According to Muncie Gear Works, Muncie, Ind., one man operating it can thread up to 6 in. pipe in any position; horizontal, vertical, or on an angle.

The 20 to 1 gear reduction unit may be driven by any ½ hp, heavy duty electric drill and attaches to any standard set of dies by specially designed adaptor yokes. An aluminum casing houses a bull gear and cold rolled spur gears, all sealed in grease for long life. After threading is completed, insertion of the drill head into a "reverse" drive socket allows removal of the die.



Pipe Threader



Reversible Smoke Box

Steel Boiler Smoke Box Is Reversible

No. 4177—A new feature on the "Square Heat" type R steel boiler of Kewanee Boiler Corp., Kewanee, Ill., is a reversible smoke box which will accommodate either a rear or top outlet connection. According to the company, it is only necessary to remove the eight bolts from the single steel sheet forming the outlet and adjacent side, reverse, and bolt in place.

Designed for medium sized buildings, the boiler is offered in eight sizes (740 to 3000 sq ft of steam) and is designed for use with coal, gas, or oil.

New Width Sheet Added to Aluminum Accordion Type Insulation

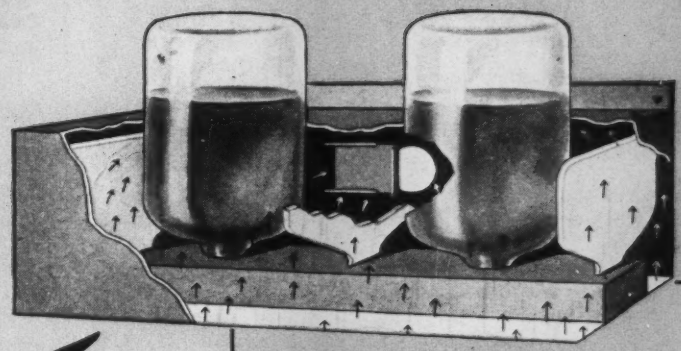
No. 4178—Infra Insulation, Inc., 10 Murray St., New York City, has added a 12 in. width, multiple aluminum sheet, accordion type insulation to its 16 and 24 in. sizes. It is designated as type 4S-12 in., S indicating that it is a standard insulation of the firm.

According to the manufacturer, it will fill a special need in those structures made with 12 in. centers, and in addition, will provide a more economical application of this type insulation in those portions of buildings which use 16 and 24 in. centers, but have a certain amount of 12 in. centers, particularly in those portions of walls near the outer walls.

The aluminum sheet used is said to have a bursting strength of 17 lb per sq in. (Mullen test) for the surface exposed to hammer blows and 15 lb per sq in. for the

ir-Aider freshens Air New Way!

- **ECONOMICAL!**
  Costs only pennies to operate
- **EFFICIENT!**
  Keeps air free of stuffiness and odors
- **FOOLPROOF!**
  No moving parts . . . minimum servicing



Cut-out view of Air-Aider showing patented evaporators

FACTS FOR AIR-CONDITIONING EXPERTS, VENTILATION ENGINEERS, CUSTODIANS, MAINTENANCE MEN!

Quickly and easily installed on the suction side of fan.

Permits greater percentage of recirculation, summer and winter . . . lower installation standards with better results and lower costs.

AIR-AID—THE AIR CORRECTIVE is a fast working fluid that is safe, non-toxic, non-inflammable. Contains no formaldehyde, no chlorophyll . . . no fatty or sulfonated oils to become rancid. Evaporates evenly to the last drop . . . leaves no scum or residue.

Air-aid

THE AIR CORRECTIVE

heck this simple, inexpensive way to control air quality!

AIR-AIDER improves the performance of almost any air-conditioning and ventilating system. It s system of odors . . . dispels "hang-over" smell . . . maintains "meadow-like fresh" air quality without perfuming the emises. It's ideal for hotels, theatres, stores, hospitals, industrial plants, large and small enterprises everywhere.

Wherever air freshening and odor control a problem—solve it with AIR-AID! which actually destroys odors d freshens indoor air.

USE THIS SPECIAL AIR-AID EVAPORATOR FOR NON-AIR CONDITIONED SPACES. Prevents odors by always having AIR-AID in the air . . . no spraying!

THIS FREE DESCRIPTIVE FOLDER! Gives additional facts on how AIR-AIDER and AIR-AID keep indoor air fresh and clean-smelling a "must" in all industrial, commercial, and institutional premises. CONVENIENT COUPON.

CORRECTIVES, INC. 441 Lexington Avenue, New York 17, N. Y.

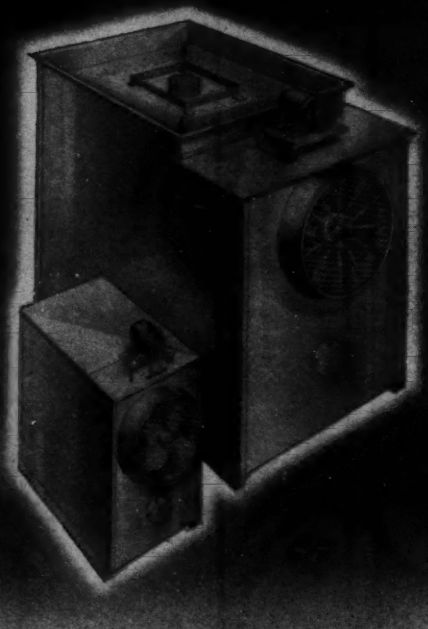
Please send me your FREE folder, "The Right Atmosphere means Better Business."

Name .....

Address .....

City ..... Zone ... State .....

SPECIFY MARLEY
Aquatower
For "PACKAGED" Cool Water



Do YOU need a cooling tower that

Requires no field erection?
Is completely assembled, ready to go?
Can be shipped immediately from stock?
Is primarily designed for air conditioning and refrigeration?
Is made from heavy steel with redwood filling?
Can be installed in limited space?
Operates indoors or outdoors?
Requires no skilled operator?
Can be readily repainted and serviced inside and out?
Ranges from 3 to 50 tons of refrigeration?
Will soon pay for itself in water savings?
Is backed by the Marley Guarantee?

If these specifications meet YOUR cooling tower needs, your best buy is the MARLEY AQUATOWER.

Designed in two styles and seven sizes, the compact MARLEY AQUATOWER packs more performance for those extra tough jobs.

Ask for Bulletin AQ-48A or let us send one of our factory trained application engineers to help you solve YOUR water cooling problems.

There is no cost or obligation.

MARLEY COOLING TOWERS

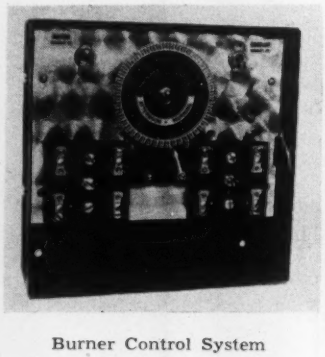
THE MARLEY COMPANY, INC.
KANSAS CITY 15, KANSAS

other surface. Pinholes are said to be eliminated. It is also said to have zero permeability to any gas, whether water vapor, cold air, or warm air.

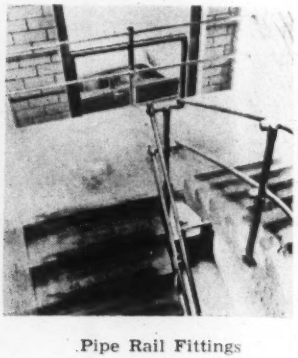
Control System Operates Oil Burners in Multiple Dwellings

No. 4179*—Tork Clock Co., Inc., 1 Grove St., Mount Vernon, N. Y., has developed the "Super T," an improved multiple dwelling fuel control for providing automatic operation of light or heavy oil burners.

Outside temperature recorded by a "Weather-Head" unit plus radiation losses of the building are said to determine the "on" and "off" action of this control. Time delay between firing periods ranges from 5 to 55 min. depending on inside and outside conditions. Firing may be stopped completely when the outside temperature reaches 55 F or any other predetermined degree. Room thermostats are not used with this control which operates on 115 or 220 volts, 60 cycle, a-c.



Burner Control System



Pipe Rail Fittings

Aluminum Pipe Fittings Cut Erection Costs

No. 4180—Aluminum fittings for pipe structures, said to reduce installation time up to 80 percent, are now included in the line of products of Reynolds Metals Co., 2500 S. Third St., Louisville 1, Ky.

Called "Nu-Rail," these fittings consist of three basic units from which 14 different arrangements can be made, plus a modified cross, floor and wall flange, and end plug. When combined with the company's aluminum pipe, many new pipe structures, as well as all conventional types of structures, can be produced, says the firm. Recommended applications include hand and guard rails, canopies, scaffolds, and stair rails.

Equipment Shorts

American Radiator & Standard Sanitary Corp., Pittsburgh, has reopened three of its plants. A satisfactory reduction in inventories and an upturn in business are the reasons given for opening the plants which are located in Baltimore, Bayonne, N. J., and Buffalo. . . . . **Superior Sheet Steel Div., Borg-Warner Corp.**, Chicago, has sold its plant near Canton, Ohio, to Louis Berkman Co., Steubenville, Ohio. The division was formerly engaged in rolling and galvanizing sheet steel and steel products, and the plant capacity was about 12,000 tons of steel per month.

Marlo Coil Co., St. Louis, has purchased additional land adjacent to the present plant site for expansion purposes. The new addition will give the company an entire city block devoted to manufacturing. . . . . .

Bryant Heater Div., Affiliated Gas Equipment, Inc., Cleveland, recently conducted the first of a continuing series of service schools at its headquarters for distributor, dealer, and gas company service men.

Cooper Alloy Foundry Co., Hillside, N. J., is offering cash and prize awards totaling more than $5000.00 for the best technical papers on applications for cast stainless steel. It is the present intention of the company to cover the major fields of application in a series of contests, the chemical field having been selected for the first contest. Contestants may be students, fellows, professors, field engineers, sales representatives, technical writers, and others connected in any way with engineering, metallurgy, market development, or industrial sales.

Payne Furnace Div., Affiliated Gas Equipment, Inc., Beverly Hills, Calif., has moved its manufacturing facilities from that city to Monrovia, Calif., where plants of the Day & Night Division are being expanded to accommodate the Payne line. Two new buildings are nearing completion for sales offices, the research staff, and warehousing. Plants in Beverly Hills will be sold and retail operations are being discontinued. Dealers will handle the gas furnace line in Los Angeles and Orange counties where retail branches have been maintained heretofore.

Tinnerman Products, Inc., Cleveland, is building a new, modern plant in Brooklyn Village, Cleveland, which will provide 150,000 sq ft of manufacturing and office space and which will cost approximately $1½ million. The reasons given for the expansion are the large potential demand for the firm's fasteners and the fact that present facilities are too small for anticipated operations next year. . . . . **Timken Silent Automatic Div.. Timken-Detroit Axle Co.,** Jackson, Mich., recently held two-day sales meetings in Chicago and New York. Sessions were attended by regional managers and district managers in both areas.

A machine designed expressly to show the heat transfer properties of copper will highlight the exhibit of **American Brass Co.,** Waterbury, Conn., at the forthcoming 6th All Industry Refrigeration and Air Conditioning Exposition. The equipment embodies heat pump principles and includes coils, tubes, pans, and convectors of copper, as well as vibration eliminators of bronze. . . . . A solenoid actuated pen, designed to avoid ink-throwing while providing speedy recording has been developed for use on circular chart electronic potentiometers by **Brown Instruments Div., Minneapolis-Honeywell Regulator Co.,** Philadelphia 44. The pen makes use of an amplifying linkage designed so that the solenoid's high velocity reaction is almost spent before the pen is picked up and moved.

Dole Valve Co., Chicago, is now packaging its No. 20 automatic hot water air valve in a newly designed carton which may be used for counter display. In addition, each valve in the carton is packaged individually and is wrapped in an instruction sheet. . . . . The recently developed baseboard heating unit of **Rittling Corp.,** Buffalo, is now patented. . . . . **Air Reduction Sales Co.,** New York, has extended its "Aircomatic" process to include the welding of stainless steels. This process had been limited to aluminum and is a gas shielded, metal arc welding method.

SOLVE DIFFICULT

STACK PROBLEMS

this

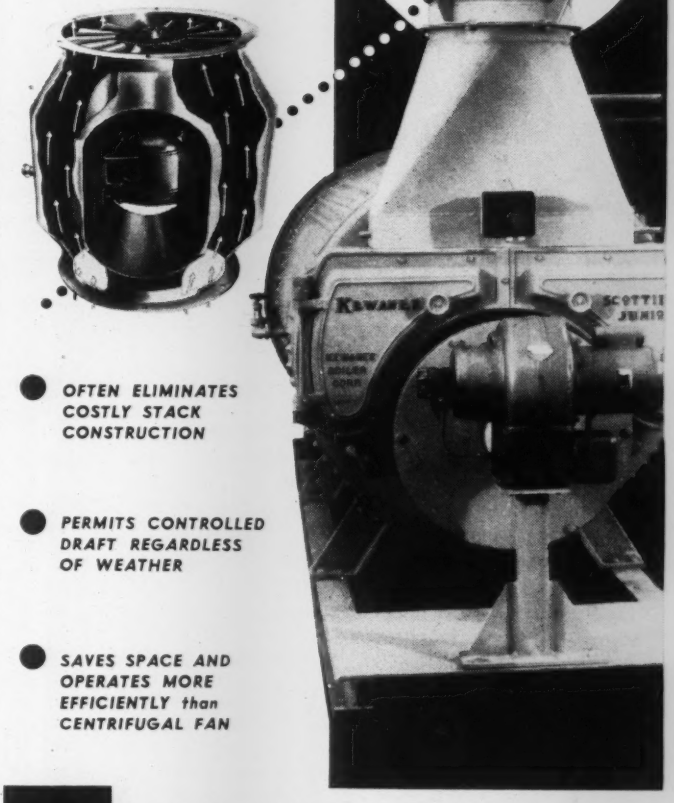
ECONOMICAL WAY

with **NEW**

DeBOTHEZAT

INDUCED DRAFT

BIFURCATOR FAN



- *OFTEN ELIMINATES COSTLY STACK CONSTRUCTION*
- *PERMITS CONTROLLED DRAFT REGARDLESS OF WEATHER*
- *SAVES SPACE AND OPERATES MORE EFFICIENTLY than CENTRIFUGAL FAN*

DeBothezat Induced Draft Bifurcator Fans can be installed in vertical stack or horizontal or angular breeching. The Bifurcator is a direct motor driven fan with a divided housing. Gases by-pass motor which is isolated in through-ventilated, asbestos lined chamber. For operating temperatures up to 650° F. Also special construction for higher temperatures.

Fan can be connected to firing controls, for uniform draft. Motor easily accessible. No belt, countershafts or platforms required.

FAN SIZES 12" THROUGH 27". For Boilers from 6 HP (200,000 BTU per hour) up to 350 HP (12,000,000 BTU per hour).

Write today for complete details and prices.

DeBOTHEZAT FANS DIVISION

AMERICAN MACHINE AND METALS, INC.

Dept. H-10, East Moline, Illinois

You can get
DIRECTED AIR FLOW
at any angle with

INDEPENDENT
"Fabrikated"
REG. U. S. PAT. OFFICE
AIR CONDITIONING
REGISTERS

321-A HMV

Rear View Showing "HMV" Valves

Every grille bar adjustable individually—before or after installation

321-A HMV Tandem

Any direction of air flow—right, left, up, down and any combination—is easily obtained with "Fabrikated" Style No. 321-A HMV air conditioning registers, for residence or commercial installations, on sidewalls or ceiling. The face bars are adjustable to right or left; valves on the back are adjustable to direct the air flow up or down; valves may also be fully closed, and are connected to open or close in unison.

The angles of deflection and the combinations to be had are practically unlimited. Adjustments for directed air flow may be made before or after installation. Grille bars are held firmly in place and will not vibrate or rattle.

"Fabrikated" registers are available in sizes from 8 x 4″ to 48 x 24″, including tandem style. Special sizes can be made without special die set-up charges.

Write for Catalog No. 48.

Always Leading—Always Progressing

THE INDEPENDENT REGISTER CO.
3747 E. 93rd STREET · CLEVELAND, OHIO

WHO'S WHAT

Louis Ruthenburg has been elevated to the newly created post of chairman of the board and chief executive officer of **Servel, Inc.**, Evansville, Ind. He has been president since 1934 and is succeeded by **W. Paul Jones** who is also general manager and a director and who resigned as vice president and director of Philco Corp., in charge of the refrigeration division, to accept the post. ..... **Harvey A. Wagner** is now chief mechanical engineer, mechanical engineering division of the engineering department, **The Detroit Edison Co.** He joined the company in 1928 and is the author of a number of articles on high temperature high pressure piping, published in HPAC.

The new general manager of **Peabody Engineering Corp.**, New York City, is **Eric G. Peterson** who continues as general sales manager of all products in all divisions. ..... **Gerald F. Twist** is managing the **Peerless Pump Div., Food Machinery and Chemical Corp.**, Los Angeles. Since January of this year he has been vice president and manager of Food Machinery's newly acquired subsidiary, Stokes & Smith Co., Philadelphia. In his new post he succeeds **Francis F. Fairman, Jr.**, who has resumed his former association with General Electric Co.

James Dalton Cunningham, president, Republic Flow Meters Co., has been elected the president (1949-50) of the **American Society of Mechanical Engineers** by national letter balloting. **John Clifford Reed**, head of the mechanical engineering dept., Bucknell University, and the author of several articles on fluid flow, published previously in HPAC, has been elected from Region 3 to serve for two years as regional vice president. **Thomas E. Purcell**, Duquesne Light Co. and Allegheny County Steam Heating Co., has been elected for the office of director at large to serve a four-year term. He is also the author of several articles previously published in HPAC.

A. R. Welker, secretary and treasurer of **C. A. Dunham Co.**, Chicago, has completed 39 years of service with the company. At a recent board meeting, directors passed a resolution extending to him appreciation of his services in many positions. ..... **Westinghouse Electric Corp.**, Pittsburgh, has made a number of personnel changes. **Henry N. Muller, Jr.**, manager of the educational department, is now assistant to the vice president in charge of engineering. **G. L. MacLane, Jr.**, is managing the engineering laboratories and has succeeded **Thomas L. Spooner** who has retired after 40 years with the company. **F. D. Weatherholt** has been named manager of industrial sales, and **Hendley Blackmon**, managing editor of Electrical World since 1947, is assistant manager of the firm's engineering association activities.

Frederic I. Lackens, for 12 years advertising manager of **Hays Corp.**, Michigan City, Ind., has retired and is succeeded by **Phil Sprague, Jr.**, who received his MBA degree from Harvard business school in 1948. ..... **John H. Sheusner** has been appointed chief engineer of **Enterprise Engine & Foundry Co.**, San Francisco. During five years with the company he has been chief design engineer. ..... **Dr. N. W. Snyder**, of the

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mechanical engineering dept., University of California, has joined the staff of **Santa Fe Tank and Tower Co.**, Los Angeles, as chief technical consultant. He has conducted numerous experiments on thermal radiation and heat transfer and was in charge of a cooling tower project sponsored by the American Society of Heating and Ventilating Engineers (report published in February 1949 issue of HPAC).

Thomas R. Byrley has been named manager, **Comfort Ray Radiant Baseboard Div., United States Radiator Corp.**, Detroit. He was formerly with A. P. Woodson Co., Washington, D. C., heating engineers and contractors, since 1936 and is the author of a boiler rating manual and numerous technical articles. ..... **Charles R. Kuglin** is now chief mechanical engineer for **Childs & Smith**, Chicago architectural firm. ..... **Chin Fun Kwok**, Shanghai, China, has been the guest of **Johnson Service Co.**, Milwaukee, where he attended a training course for a group of mechanical engineering graduates from the United States and Canada. He is spending a year studying at various plants in the air conditioning field before returning to Shanghai.

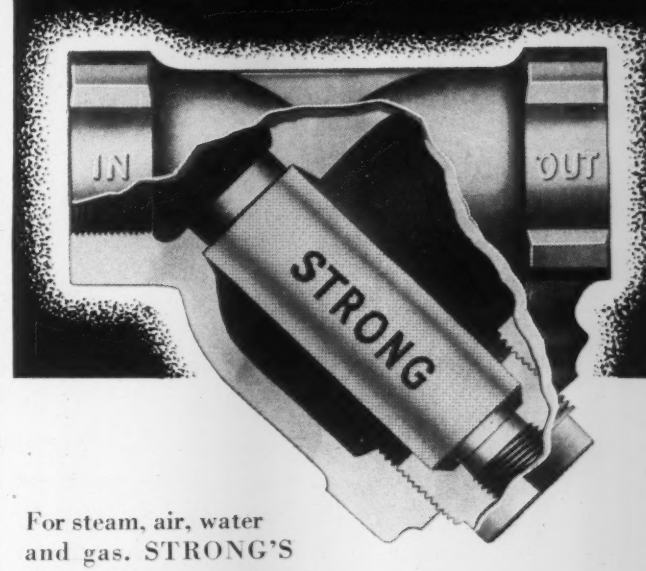
With headquarters in the New York City factory sales office, **Oscar C. Stark** is managing sales of **Photoswitch, Inc.**, Cambridge, Mass. He had been associated with Square D Co. in various sales and management capacities since 1930. ..... Through its newly created application selling department, **American Radiator & Standard Sanitary Corp.**, Pittsburgh, is offering to customers technical information on design, installation, and care of its products. **Walter Wehner**, formerly of the Newark sales office, is in charge and is assisted by **Charles T. Woodroof**, product specialist in the general sales department, and **N. H. Richfield**, of the manufacturing department.

United States Rubber Co., New York, has named **Howard H. Weber** as general sales manager of the wire and cable department. He will supervise sales of a variety of products, including "Uskon" electric radiant heating units. ..... As manager of the recently created new products division, **W. A. Matheson, Jr.**, is handling subcontracting for fill-in production and new product research for **Perfex Corp.**, Milwaukee. He was formerly manager of contract sales for Williams Oil-O-Matic Div., Eureka-Williams Corp.

General Controls Co., Glendale, Calif., has opened a new factory branch office at 307 E. 4th St., Cincinnati, with **Jack Prutow** in charge. The firm's Oklahoma City office has been moved to 1427 E. 6th St., Tulsa, and **O. D. Shaddox** continues as branch manager in the new location. At the home office, **W. E. Conkright** has been appointed sales promotion and advertising manager. ..... **Crotty Co., Inc.**, Flushing, N. Y., engineers and contractors, is now the exclusive franchise distributor in Manhattan and the Bronx, for the oil burning line of **Combustion Equipment Div., Todd Shipyards Corp.**

Modine Mfg. Co., Racine, Wis., has appointed three new sales representatives. **T. R. McGovern**, 5720 Wilshire Blvd., is covering the Los Angeles territory. **J. R. Dowdell & Co.**, 4024 Swiss Ave., Dallas, is covering that

USE STRONG* STRAINERS
-for *better* protection!



For steam, air, water and gas. STRONG'S new "Y" type strainer is ideal for the protection of steam traps, reducing valves, temperature controls, air control equipment, pumps, etc.

A HIGH-QUALITY, LOW-COST STRAINER!

★ **Monel Screen**—Mesh cloth in sizes ¼" to ⅜", larger sizes standard with .027 perforations. Self-centering guides prevent crushing.

★ **Semi-steel Body**—For rugged service. Sizes ¼" to 2". For steam pressures to 250 psi, cold pressures to 400 psi.

★ **Easy Installation**—New V-shaped gripping lugs on inlet and outlet bosses—may be easily installed with any type wrench.

CAST STEEL "Y" STRAINER

Available for pressures to 600 psi, screwed and flanged. Sizes ¼" to 4".

*Reg. Trade Mark

STRONG, CARLISLE & HAMMOND COMPANY
1392 West 3rd Street
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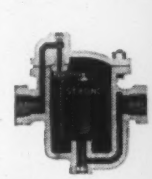
ANUM-METL Reg. Trade Mark

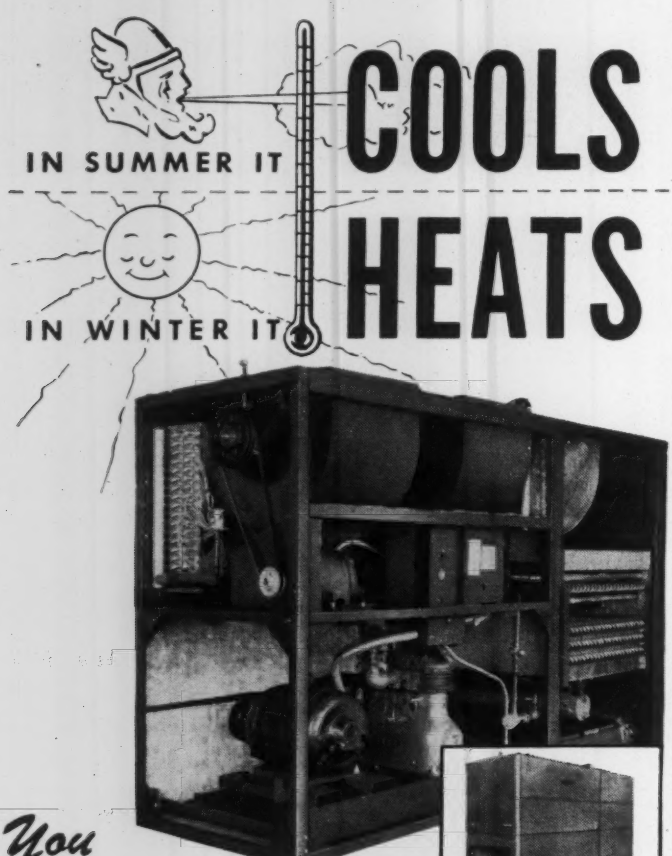
OTHER STRONG STEAM SPECIALTIES


No. 070 Small Trap

80 Series Trap

"T" Type Strainer

STRONG



You

can provide both with the

BAKER CENTRAL-AIR

Make your air conditioning ductwork do double duty. It carries cooled air on warm days; *it can also carry warmed air on cool days.*

Heating coils, attached to a steam or hot water boiler, can be installed within the Baker Central-Air cabinet, transforming this air conditioner into a powerful unit heater. With the cooling and de-humidifying section turned off, the air handling section will project warmed air throughout the ductwork system, providing circulation and ventilation as required. The Baker Central-Air thus becomes an efficient warm-air circulator — an economical answer to the heating problem for many locations.

Baker Central-Air is also the perfect answer to the air conditioning problem for central station applications. It is completely assembled and tested at the factory, and is available in 8 models, 5 to 40 ton capacity. Let us send you full information.

We manufacture a complete line of air conditioning and refrigeration equipment including compressors and condensing units for Freon and Ammonia, and all accessory material. 5

BAKER
REFRIGERATION CORPORATION
General Offices: South Windham, Maine
Factories at South Windham, Me., and Omaha, Neb.

territory, and **Safex Engineering Co.**, (Pty.) Ltd., Johannesburg, South Africa, represents the firm in the Union of South Africa and the Rhodesias. ..... **F. J. Evans Engineering Co.**, with headquarters in Birmingham, Ala., and branch offices in Houston and Atlanta, is representing **Clayton & Lambert Mfg. Co.**, Louisville, Ky., in the states of Tennessee, North and South Carolina, Florida, Alabama, Mississippi, Louisiana, and the Houston area of Texas. **Mercury Sales Co.**, Syracuse, is representing the firm in northern New York state.

Earl Roberts is now a sales engineer in the Memphis branch of **Black & Decker Mfg. Co.**, Towson, Md. He had been in the company's service department at Memphis. ..... **Robert L. Major** is a new sales engineer for **Kaylo Div., Owens-Illinois Glass Co.**, Toledo, and will make his headquarters in Pittsburgh. In Toledo **William R. Lugar** is the new sales control supervisor for the division and will work on sales forecasts, quotas, bonuses, expense analyses, etc.

A number of personnel changes have been made by **Air Reduction Sales Co.**, New York. **J. K. Hamilton** is now manager of the apparatus research division, with **H. O. Klinke** as assistant manager. **J. T. McKnight** is supervising the production and services section, and **T. J. Cholis** is supervisor of the patent section. These men are all on the staff of the firm's research laboratory.

Harvey B. Lindsay, president, **Lindsay Corp.**, Chicago, recently retired from active participation in the business on his 69th birthday, and the firm has been reorganized. The successor, **Lindsay Structure, Inc.**, has acquired all patents, trade marks, and special equipment and will continue to market Lindsay products along the same national lines as heretofore but will contract for their manufacture with **Maysteel Products Inc.**, Mayville, Wis.

Mechanical Industries, Inc., Pittsburgh, is a newly formed engineering company whose activities are limited to industrial ventilation, smoke, dust, and fume control. The president and general manager is **Morton I. Dorfan** who has been associated in this field for more than 35 years. Prior to establishing the firm he now heads, he supervised dust control sales, engineering, and research activities for American Wheelabrator & Equipment Corp.

John A. Robinson has been named regional sales manager for the midwest, northwest, Rocky Mountain, and Pacific coast areas of **Brown Instruments Div., Minneapolis-Honeywell Regulator Co.**, Philadelphia. He will make his headquarters in Chicago where he has been branch industrial manager. **George E. Gilliam** is now managing pyrometer supplies sales nationally. He has been with the company for the last five years, most recently at the South Bend branch office, and is now located at the home office. **Charles E. Sharp**, who has been in the Chicago office for the last five years, has taken over Mr. Robinson's former post. **Charles D. McIntire** is the new industrial sales manager of the Cincinnati office and has succeeded **George Brown** who has been assigned to promotion of products of Honeywell's Belfield valve division. **John E. MacConville** is managing industrial sales in Atlanta and is also supervising activities out of the Birming-

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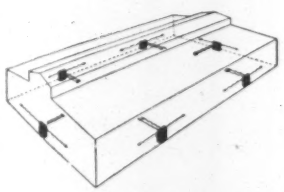
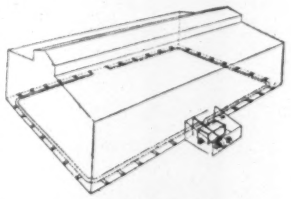
Direct Fired

WARM AIR HEATERS* by LEE

** a COMPLETE line for every application*



One or more heaters is placed inside of the space to be heated.

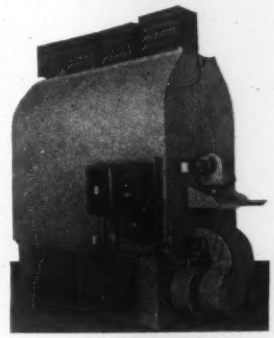


Heater is placed in a central location, warm air being delivered by ducts to space heated.

Whatever your needs in large scale heating you will find a Lee Direct Fired Unit to handle the job efficiently and economically. Over thirty years of experience in building quality heaters guarantees the proper unit for the job whether you contemplate a unit or central system. Illustrated at left are the two types mentioned — the top diagram shows an installation using one or more heaters in which capacities from 300,000 to 6 million Btu may be obtained. The bottom diagram illustrates the central system in which the heated air is distributed through ducts in which 3 million to 8 million Btu may be developed.

The efficiency of the Lee counter-current flow reduces fuel consumption; while the rugged simplicity of the system decreases cost of installation, assures low maintenance charges, and also provides ventilation without additional cost. In addition to normal heating installations Lee Direct Fired Units may also be used for drying and curing in cases where these two operations are required.

It will pay you to investigate the Lee line today—literature is available describing completely the principal types of construction and versatility of operation as well as a partial list of prominent and satisfied Lee customers.



Please write us today.

LEE ENGINEERING COMPANY

95 River Street **Hoboken, N. J.**

2 ways to CUT assembly costs!

DRILL IT!
with a B & D HOLGUN. Drills holes to ¼" diameter in steel to ½" in hardwood.

DRIVE IT!
with a B & D SCRUGUN. Drives machine screws and nuts to ¼", self-tapping screws to #12, wood screws to #10 x 2". Positive or adjustable clutch available.

B & D HOLGUNS,* SCRUGUNS* give you MORE WORK

Per MAN These Tools are perfectly balanced, weight saving, compact, with famous "Pistol Grip and Trigger Switch". Accurate and easy to handle. Help your men produce more, with less fatigue and less work spoilage.

Per HOUR Abundantly powered by B&D universal motors, they have full power and speed for continuous use—help you do more sheet metal assembly per hour, *every* hour!

Per TOOL These Tools give you *extra* years of service! Extra-tough gears, shaft and chuck spindle, powerful motors, husky housings are *built to last!*

WRITE TODAY for free, detailed catalog to: THE BLACK & DECKER MFG. CO., 628 Pennsylvania Ave., Towson 4, Md.

*Trade Mark Reg. U. S. Pat. Off.

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

PORTABLE ELECTRIC TOOLS

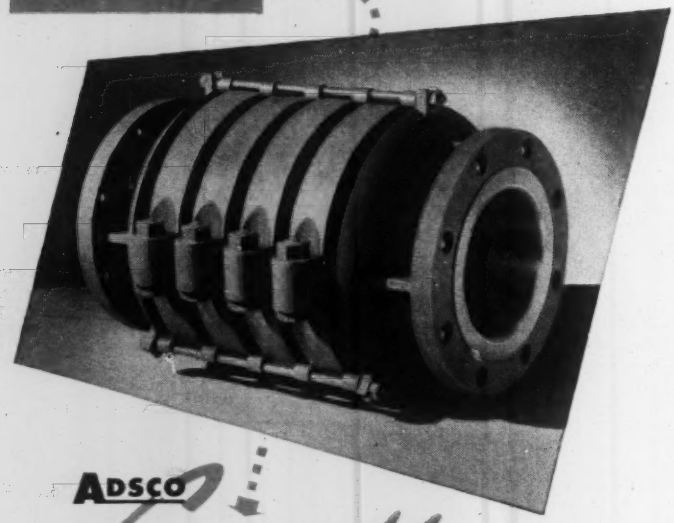
ELECTRIC SHEARS

ELECTRIC SANDERS

BENCH GRINDERS

"WHIRLWIND"* WIRE BRUSHES

ADSCO introduces



ADSCO Corruflex
PACKLESS EXPANSION JOINTS

Corruflex, ADSCO's new packless corrugated expansion joint, rounds out the most complete line of expansion joints available from any manufacturer. Only ADSCO can make both an expert analysis of your expansion problem *and* an impartial recommendation of the type of joint to use.

Corruflex, because it is packless, is ideally suited for remote and difficult-to-service installations.

Corruflex is economical because it makes expensive pipe bends unnecessary.

Corruflex is available in sizes from 3″ to 24″, single or double units, single or multiple corrugations, with or without self-equalizing rings and with flanged or welding ends. It is supplied in copper, stainless steel or other alloys and with internal sleeves if required.

Corruflex has a traverse range from fractions of an inch to 15″ and will operate under pressures from vacuum to 300 lbs. and temperatures from sub-zero to 1600° F.

For further details, consult your ADSCO representative or write for Folder No. H-149.

AMERICAN DISTRICT STEAM CO.
NORTH TONAWANDA, N. Y.
SINCE 1877

ham, Jacksonville, and Knoxville offices. **William C. Waltman,** formerly in the Syracuse office, has succeeded Mr. Gilliam in South Bend.

Henry Valve Co., Melrose Park, Ill., has named **Raymond J. McCahill** field engineer for southern Illinois, Indiana, Missouri, and Kansas. He has been in the firm's sales organization since August, 1948 ..... **Albert M. Lovenberg** has opened his own consulting engineering office at 61 Bliss St., Springfield, Mass., and is specializing in heating, air conditioning, and refrigeration. He has been associated with various heating and air conditioning contractors as an application engineer for the past 25 years and is well known in New England engineering circles.

The Lycoming and Spencer Heater Divisions of **Avco Mfg. Corp.**, Williamsport, Pa., have been integrated into a single operating unit known as the **Lycoming-Spencer Division. S. B. Withington,** newly elected vice president of Avco, is managing both plants. ..... **Fred H. Gallup** is the new manager of distributor sales of the automatic heating division, air conditioning dept., **General Electric Co.**, Bloomfield, N. J. He formerly represented various heating equipment manufacturers throughout metropolitan New York. The department has recently franchised five additional firms as parts depots. They are: **Paramount Electrical Supply Co., Inc.**, New York City; **United Commercial Sales Co.**, Los Angeles; **Perry-Mann Electric Co.**, Columbia, S. C.; **Capson Co., Inc.**, New York City; and **A. Wayne Merriam, Inc.**, Albany, N. Y.

Robert R. Briggs is a factory representative in Michigan, northern Indiana, and northwestern Ohio for **Viking Air Conditioning Corp.**, Cleveland. **Jack Green** has been appointed in a similar capacity for the Cincinnati territory covering southern Ohio, eastern Indiana, eastern Kentucky, and West Virginia. Mr. Briggs was formerly in the sales department of Proctor and Gamble Co., and Mr. Green has been with Viking in various capacities for several years.

Edward S. Steigner, for 15 years a member of the metallurgical department, **Youngstown Sheet and Tube Co.**, Youngstown, Ohio, is now tubular products development engineer with headquarters in the Campbell works office building. **David H. Goodfellow,** a member of the company for 18 years, is the new assistant district sales manager in the Detroit office, and **John L. Warner**, who is assistant superintendent of the South Chicago coke plant, has been elected secretary of the Blast Furnace and Coke Association of the Chicago district.

R. Kay Crandall, formerly chief engineer of Construction Management, Inc., is now associated, as chief engineer, with **Beiswinger and Hock,** consulting engineers, Akron, Ohio. ..... **Frank J. Aschenbrenner** and **Earl C. Clark** have been appointed assistant directors of research and engineering, **Air Reduction Sales Co.**, New York City. Mr. Aschenbrenner is in charge of the Murray Hill, N. J., laboratory and Mr. Clark is in charge of the development and engineering groups. The technical relations department has been transferred from research and engineering to the secretary's department.

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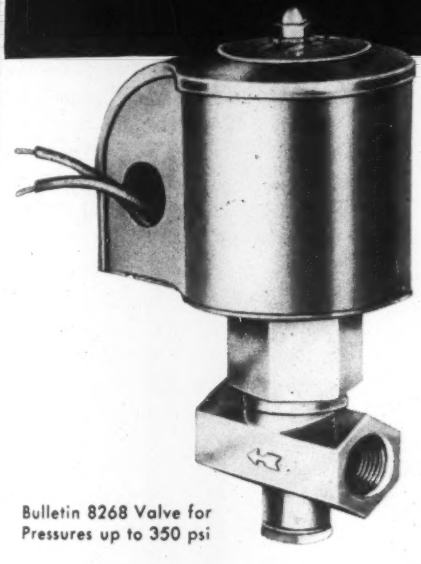
Bulletin 8265 Valve for Pressures up to 250 psi

STURDY PACKLESS SHUT-OFF VALVES FOR



GAS

OIL

WATER

Bulletin 8268 Valve for Pressures up to 350 psi

These ASCO Valves are small and compact with ample reserve power and large safety factors. Each is available with resilient seat and disc construction to assure absolute bubble-tight seating. The sturdy construction permits exceptionally fast and controlled operation.

Both valves have important "approvals". Bulletin 8265 valve is approved by Factory Mutual and Underwriters' Laboratories; Bulletin 8268 Valve is available with explosion-proof solenoid approved by Underwriters' for Class 1, Group D, Hazardous Locations.

Back of these and the many other ASCO Valves is more than 40 years' experience in the design, manufacture and application of solenoid valves. We know this field thoroughly and will be glad to serve you on any automatic control requirement. The above valves are for general purpose use in automatically shutting off the flow of gas, oil or water.

ASCO Solenoid VALVES

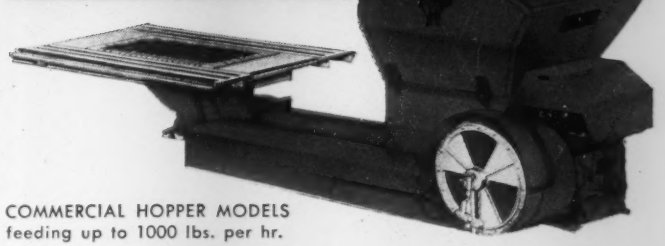
When in need of Automatic Transfer Switches, Remote Control Switches, Contactors, Relays, and Specialized Electromagnetic Controls, come to us.

Automatic Switch Co.

389 LAKESIDE AVENUE • ORANGE, NEW JERSEY

High Fuel Costs?

Save up to 30% WITH Combustioneer



COMMERCIAL HOPPER MODELS
feeding up to 1000 lbs. per hr.

Factories, plants, shops, stores, theaters, hotels, apartment houses, other large private and public buildings . . . all use *big quantities* of heat, hot water or steam . . . all can show *staggering fuel costs!*

Yet you can cut those costs . . . cut them up to 30% . . . with Combustioneer Automatic Coal Stokers. Think of that saving . . . monthly . . . or *yearly!*

Combustioneer gets *all* the heat *out* of the coal. Its exclusive "Pulsating" Transmission, Automatic Respirator and "Breathing" Fire-Bed assure highest efficiency combustion under all conditions and provide perfectly controlled automatic heat. And Combustioneer's extremely rugged design and construction pay off in long-lived dependability and lowest maintenance cost.

Hopper and bin-feed models, capacities up to 1000 lbs. per hr. Write us today for further information about how Combustioneer is saving money in your specific kind of business and can save money for *you.*

THE STEEL PRODUCTS ENGINEERING CO.
1236 W. Columbia St., Springfield, Ohio

Please send us, without obligation, further information about your commercial models of Combustioneer, and information about your free heating analysis.

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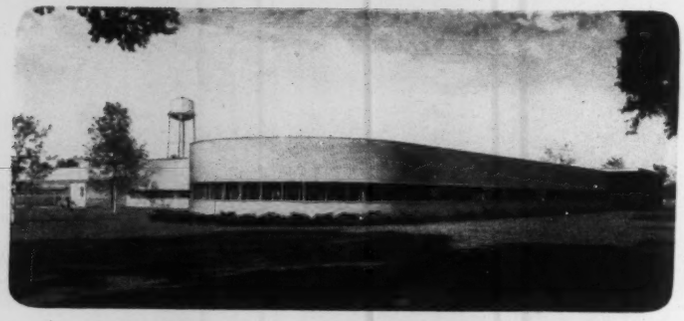
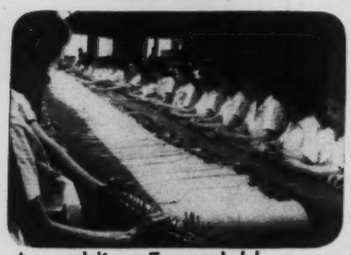


New Pharmaceutical Laboratories Air Conditioned with Frick Refrigeration

Baxter Laboratories, which have the largest production of intravenous solutions and blood transfusion equipment in the world today, use two Frick NEW "ECLIPSE" compressors for cooling the offices, research departments, and many work areas in their recently completed plant at Morton Grove, Ill. This covers 300 by 400 ft. Frick installation made by Midwest Engineering and Equipment Co., Sales Representatives in Chicago. When you want dependable air conditioning, refrigerating or ice-making equipment, engineered to your special needs, look to

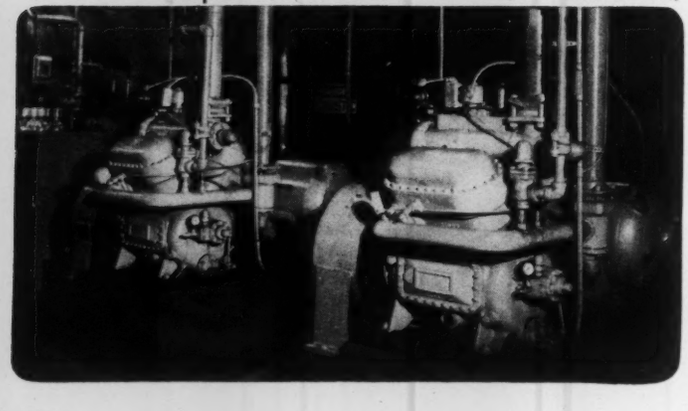
Office and Plant are Modern Throughout

One of the Air Conditioned Laboratories


Assembling Expendable Transfusion Sets

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA. U.S.A.
Also Builders of Power Farming and Sawmill Machinery

Two Frick NEW "ECLIPSE" Compressors



Walter M. Reynolds has been elected secretary of **Morse Chain Co.**, Detroit, a division of **Borg Warner Corp.** He retains his duties as controller of the division while those of treasurer have been assumed by **R. P. Johnson,** first vice president. These two positions were formerly combined in one office held by the late Stanley B. Waring. ..... **C. E. Malone Co.,** 4903 Delmar Blvd., St. Louis 8, is now representing **Gorton Heating Corp.,** Cranford, N. J., in the St. Louis area.

Vapor Heating Corp., Chicago, has acquired controlling interest in **Texsteam Corp.,** Houston, Tex. **A. J. Loose** has been elected vice president and treasurer of Texsteam. He had been located in Vapor's Chicago plant working on engineering and production of steam generators for the past 11 years. The Texas firm will continue operations under its own name and products will be distributed by **Bettis Corp.,** also of Houston.

Cochrane Corp., Philadelphia, has appointed **Samuel B. Applebaum** manager of its cold process water treating division. He is also vice president of Liquid Conditioning Corp., an operating subsidiary. ..... Several changes have been made by **E. F. Houghton & Co.,** Philadelphia, in its eastern sales division. The division has been split into two sections; eastern sales north, which includes New England and New York state, and eastern sales south, which includes Pennsylvania, New Jersey, and Delaware. **Orum R. Kerst** heads the north section and **J. R. Clendenning** has taken over the south. **A. C. Smith,** former assistant to the eastern sales manager, has been promoted to the newly created post of sales coordinator for the two eastern sections.

Eutectic Welding Alloys Corp., New York, has augmented its research staff by appointing **Dr. Eugen Sovegjarto** as consultant and researcher on the development of special electrodes. He was formerly employed by leading metallurgical concerns in Germany and has published many works in the field of analytical chemistry and metallurgy. .....**W. J. O'Connell** is the new district sales manager for **Star Tubular Products Co.,** Chicago, with headquarters in Louisville. He is covering Ohio, West Virginia, Kentucky, Indiana, northern Tennessee, southern Illinois, and Missouri.

C. J. Tagliabue Corp., Newark, N. J., wholly owned subsidiary of **Weston Electrical Instrument Corp.,** has appointed the following district sales representatives: **E. A. Thornwell, Inc.,** Atlanta; **Ranson, Wallace & Co.,** Charlotte, N. C.; **Ambos-Jones Co.,** Cleveland; **Butler and Land,** Dallas; **Lynn Elliott Co.,** Houston; **Curtis H. Stout,** Little Rock, Ark.; **Geeseka and Pinkney,** Minneapolis; **Joralemon, Craig & Co.,** Philadelphia; **J. E. Redmond Supply Co.,** Phoenix; and **Riddle and Hubbell,** Tulsa.

Cornish Wire Co., Inc., New York, has named **Alexander Norden, Jr.,** to organize and develop a new wired assemblies division which will concentrate on the design, engineering, and manufacture of staple and specialized electrical wire assemblies for equipment manufacturers. He is a pioneer radio manufacturer. ..... **Illinois Engineering Co.,** Chicago, has appointed **McLean Engineering Co.,** 105 E. C St., Yakima, Wash., its representative in that area.

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Where sudden hot water pulls—or an unpredictable time schedule—are in the order of things, install

Paracoil INSTANTANEOUS WATER HEATERS

TO KEEP PACE WITH THE LOAD—ALL THE WAY!

No storage tank is necessary—they have enough, and more, heating surface built into them to heat the water as fast as it is drawn! Thousands in use.

If you have such a problem, we have the answer! Stock designs permit quick deliveries..at prices lower than you think!

Write today for a copy of our new Bulletin 70 Section I, describing this line of Paracoil Water Heaters.

This bulletin; in addition to tables of capacities and physical dimensions on our U-Tube designs, contains a wealth of practical, worthwhile engineering data on how to size, figure steam requirements, and pipe up PARACOIL INSTANTANEOUS WATER HEATERS. YOUR COPY AWAITS YOU!

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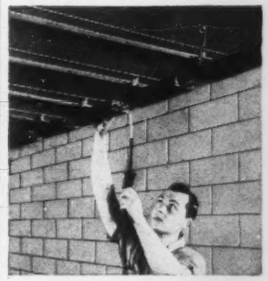
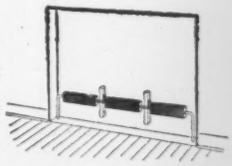
KRITZER "FIN-TUBE" RADIANT COILS

for the NEW economical
RADIANT HEATING!

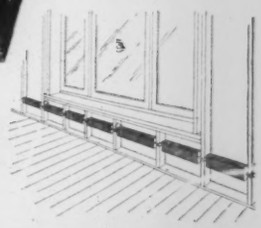
Thousands of installations have now proved the amazing advantages of Kritzer Radiant Coils from the important standpoint of heat transfer and especially the practical economy of both materials and labor. For better installations, for more profits, GET THE FACTS!



Joining coil sections with torch and solder ring. No threading. No fitting.



Kritzer Radiant Coils in recessed chamber for panel heating.



"Fin-Tube" panel heating in picture window wall.

A finished heating section on Kritzer hangers. Joists furred and ready for lath and plaster.

FOR JOISTS AND STUDS 12"—16" OR 24" O.C.

CONVENIENT LENGTHS

SIMPLE • TIME-SAVING DOLLAR-SAVING

A single Kritzer Radiant Coil supplants several lengths of ordinary tubing. These coils are a single ⅝" copper tube with mechanically bonded 1½" x 3" aluminum fins, ¼" apart. Here is efficient heat transfer with first cost the last cost. WRITE TODAY and send the coupon.

IF IT'S KRITZER, IT'S RIGHT SIR

NEW DESCRIPTIVE FOLDER AVAILABLE

KRITZER RADIANT COILS, INC.
2905 West Lawrence Avenue, Chicago 25, Illinois

Gentlemen: I'm interested. Please send complete information and bulletin on KRITZER "Fin-Tube" Radiant Coils.

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Firm_____

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FREE BULLETIN

on how to drain corrosives

This 12-page bulletin tells you how, why and where you should use Duriron acid-proof drain equipment for corrosive wastes.

It includes—the physical, mechanical and corrosion-resisting properties of Duriron compared to other materials ...engineering data on Duriron equipment... application in chemical laboratories, engraving plants and industrial acid waste systems . . . proper installation practice.

Find out how you can protect your waste disposal system against costly corrosion. Use the coupon, today.

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Please send me your free bulletin 703.

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NEW BOOKS & REPORTS

Nontechnical Articles Provide a Better Appreciation of Atomic Energy

I am certainly glad that I was asked to read and review Constructive Uses of Atomic Energy, so capably edited by S. C. Rothmann. This collection of 14 articles takes you completely away from the atomic bomb and its secrecy, and made me, at least, realize more fully how much the atomic age is actually here. As A. H. Compton points out in the leadoff article, "Atomic energy is just one more step along the path of technological progress. It may, however, be the supreme gift of physical science to the modern age."

Many of the new words of this atomic age—reactor, half life, isotopes, elements not found in nature, alpha, beta and gamma rays—no longer seem formidable as you read of their meaning and application to everyday living. You learn that tracer techniques utilizing radio-active materials in biology, medicine, metallurgy, and agricultural research have been in progress for several years. The atomic power plant seems much nearer when the problem is reduced by Mr. Etherington to the familiar design problems of materials of construction, the development of shapes and shields, the questions of heat exchangers, and personnel protection. And when one pound of the fuel of the atomic power plant has the potential energy of 1.5 million tons of coal, you feel pretty confident the economics will eventually favor the reactor over the steam boiler and that the incentive is ample to justify the research and design thinking necessary.

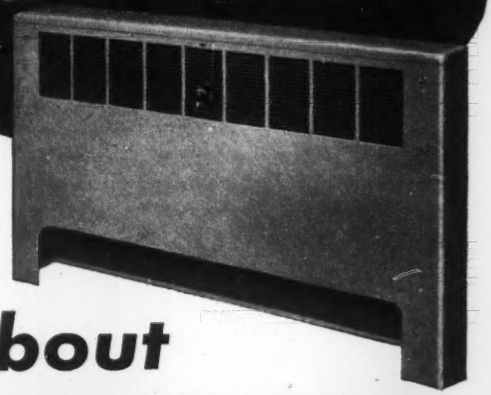
Against the background of this discussion, examples so frequently used take on more meaning. That an atom if it weighed a pound would, due to its speed, have the effect of a 150,000 ton bullet no longer seems fantastic. Nor does the ability of a gram of uranium to produce 24,000 alpha particles (helium atom nuclei, you learn) per sec for 4.5 thousand million years and still be only half through its disintegration process seem so strange.

I wonder if it is generally realized that radioactive isotopes of most elements can be produced and that their rates of decomposition vary over the whole time concept of seconds to millenniums. The use of 5 milligrams of radio active phosphor in 600 lb of phosphate can be spread over 2 acres. With plants absorbing less than 10 percent of the phosphate and the radio active phosphate being 99.9 percent decomposed at the end of the growing season, still accurate measurement of amount of phosphate utilized by one gram of the plant tissue can be made—an excellent illustration of the tracer technique and the selection of radio active materials of suitable decomposition cycles.

The reader of this short collection of nontechnical discussions will have a clearer understanding of a reactor, the production of radio active elements, the alpha, beta, and gamma rays and their significance. Utilization of this new tool in industry will be forecast and he will daydream about the new knowledge that will be made available as the smashing of the atom gives a "shot in the arm" to increase emphasis on basic research in physics, chemistry, and other pure sciences.

The glossary of scientific terms in the appendix should prove a useful reference for the layman wherever atomic energy discussions are encountered.

Money making facts for plumbers and jobbers



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CONVECTOR-RADIATORS

1 HANDSOME APPEARANCE

Blends with customers decorative and color scheme.

2 BETTER COMFORT

Gentle, active circulation gives more uniform temperature from floor to ceiling.

3 QUICK RESPONSE

To thermostatic or manual control, thanks to copper and aluminum heating elements.

4 EASY TO INSTALL

America's most complete line...models for every need. Easy to stock. Packaged units, light weight. A boy can carry them.

5 NEW LOWER PRICES

Write for new Price Lists just off the presses.

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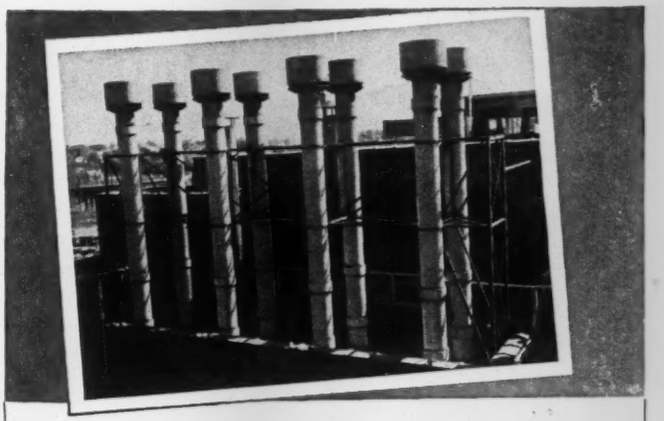
Dept. HP-H3 **BUFFALO 7, N. Y.**



Records show long service in tough service . . .
for Transite Industrial Vent Pipe

Workable: Transite can be cut and drilled on the job.

IN INSTALLATIONS in many industries where corrosive fumes, vapors, dusts, and gases are encountered, Transite Industrial Vent Pipe is yearly demonstrating the fact that it is a practical, economical answer to tough venting problems.

Because it is an asbestos-cement product, this strong, durable pipe stands up in many types of corrosive service . . . helps avoid costly replacement . . . results in important reductions in plant maintenance.

Easily installed—Transite Industrial Vent Pipe has many practical installation advantages. It is light in weight and easily handled. It is readily worked and can be quickly cut and drilled on the job with ordinary tools.

Adaptable: A complete line of Transite fittings meet most requirements.

Easily adapted—Made in a range of sizes up to 36" in diameter, Transite Industrial Vent Pipe is readily adapted to use as vents, ducts, and stacks. A full line of Transite fittings provides a venting system that is corrosion-resistant throughout.

Economical to maintain—Transite is completely rustproof . . . highly weather-resistant . . . needs no painting . . . resists corrosion outside, inside and all the way through. For full details about Transite Industrial Vent Pipe, write Johns-Manville, Box 290, New York 16, N. Y.

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TRANSITE Industrial Vent PIPE

All Roads lead to...

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Lay your plans now to attend this great Exposition. Here will be concentrated the latest developments in conditioning air in all types of buildings, industrial plants and homes. Nowhere else can sales, design and consulting engineers; contractors; and distributors get so much information in so little time—compare the newest advances in air conditioning, heating, ventilating, and related equipment.

The new products you'll see—from complete units to maintenance supplies, the wealth of new stimulating IDEAS you'll absorb will be invaluable to you. Remember the dates. Bring your associates.

Under Auspices of American Society of Heating and Ventilating Engineers

Management International Exposition Company
Grand Central Palace, New York 17, N. Y.

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Published by Harper & Brothers, 49 E. 33rd St., New York 16, the 258 page (8 x 5¼ in.) book is priced at $3.00 and is clothbound.—Reviewed by John M. Kane, chief engineer, dust control division, American Air Filter Co.

Summarizes Present Knowledge of Atmospheric Environment Effects

The requirements for a comfortable and pleasant environment and a satisfactory standard of atmospheric purity are the conditions most favorable to full health. This conclusion was expressed by Dr. Thomas Bedford before the Institution of Heating and Ventilating Engineers when he delivered the first Napier Shaw Premium Lecture.

His paper is essentially a brief survey of the present state of knowledge on the effects of atmospheric environment on the health, feeling of well-being, and efficiency of the worker. In discussing the effects of air conditioning on health in industry, he defines the term air conditioning as implying any treatment of air. Numerous specific cases are cited, together with technical reports to explain the effects of adverse temperatures, inadequate ventilation, and atmospheric pollution. Considerable attention is given to air conditioning and the spread of respiratory infections, working efficiency and atmospheric conditions, and comfort in terms of air movement and various scales of warmth.

Dr. Bedford's remarks and the various cases cited by him, particularly the Metropolitan Life Insurance Co. offices (reactions of office workers reported in the May 1940 issue of HPAC) serve to emphasize the fact that results of physiological studies dealing with comfort, working efficiency, and accident rate are far more conclusive than studies on air conditioning and the spread of disease and the incidence of sickness.

In regard to industrial ventilation rates, Dr. Bedford recommended four to six air changes per hour, together with suitable dust suppressive measures. In the discussion period which followed, the question was brought up as to whether these figures should be modified for cases where unusual ceiling heights are encountered. In reply, he stated that obviously some account would have to be taken for unusually high ceilings but pointed out that the figure of four air changes was a rough and ready statement for the general run of conditions. He agreed that where there were large differences in the density of population, the number of air changes per hour was not an ideal measurement.

The lecture and discussion are reported in the Vol. 17, No. 166 issue of the Journal of the Institution of Heating and Ventilating Engineers, 75 Eaton Pl., London, S.W.1, England.

Other Books and Reports Received

Contractors' Equipment Ownership Expense Manual, published by the Associated General Contractors of America, Inc., Munsey Bldg., Washington 4, D. C., $1.00 per copy, discounts for ordering in quantities. This is a compilation of data on average costs to general contractors of owning and operating various kinds of construction machinery and equipment. In this newly revised edition, 1400 equipment items have been added and tentative percentages are given for these new items. Sample costs, previously listed, are now omitted.

Spoilage of Grain Prevented!

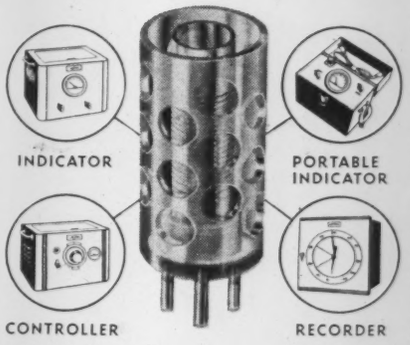
AMINCO DUNMORE

ELECTRIC HYGROMETER

A nationally prominent food manufacturer is now able to save huge amounts of grain formerly spoiled by excessive moisture.* By placing Aminco-Dunmore Electric Hygrometer Sensing Elements in grain-storage bins, moisture in the air between the individual grain particles can be readily detected and controlled, spoilage due to fermentation prevented, and greater profits realized.

The importance of accurate and speedy detection and control of moisture is being realized more and more by manufacturers of drugs—foods—cement—paper—glass—photographic films—gases; also by packagers of a wide variety of hygroscopic materials——and they are employing the Aminco-Dunmore Electric Hygrometer with phenomenal success and increased profits.

Cereal Chemistry, March, 1949, p. 166.



This tiny element (illustrated actual size) is used in conjunction with one or more of the instruments shown in circles above for obtaining various combinations for measuring, recording, and controlling relative humidity.

MOST SENSITIVE
Detects humidity changes as small as plus-minus 0.15% relative humidity.

SPEEDIEST IN RESPONSE
Responds instantly to micro changes in relative humidity at temperatures from 40° to 140° F. Response is slightly slower below 40° F., whereas other types are unresponsive.

MOST ACCURATE
Measures accurately within plus-minus 1½% relative humidity, without periodic attention.

OCCUPIES LESS SPACE
Sensing element occupies a maximum of two cubic inches.

MOST RELIABLE
Guaranteed for one year. Will give many more years of satisfactory service when used properly.

MOST VERSATILE
1. Can be used to measure, indicate, record and/or control relative humidity, also to drive air-operated devices.

2. Can be used for remote control operation, since long connecting lines may be employed.

3. Since it does not add or remove moisture or heat, it can be built into hermetically-sealed electrical components.

4. The small size and weight of the sensing element enhances its adaptability.

5. Measures moisture content of solids as well as of air and other non-corrosive gases.

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Since 1919 AMINCO

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Scientific Instruments
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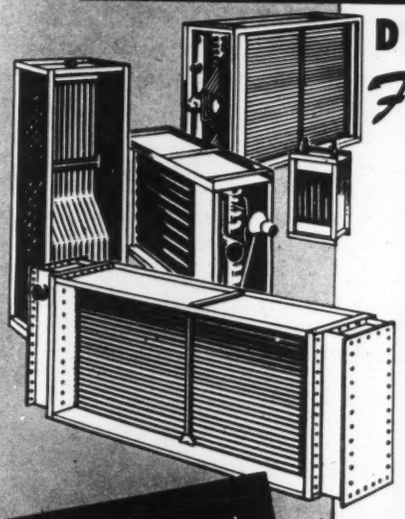

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For Every Heating and Cooling Problem

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Aerofin's continuous research has developed extremely efficient coils, accurately rated. You can install to full rated capacity with assurance of full efficiency for the life of the unit.

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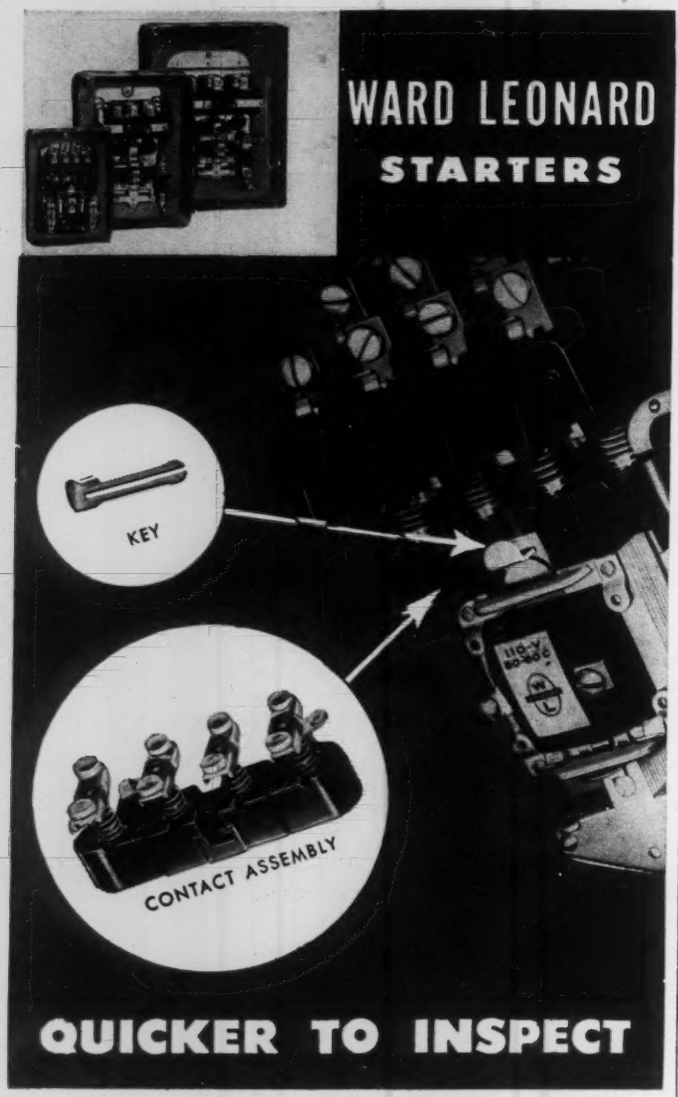

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Removing a single key permits the entire moving contact assembly to be withdrawn for inspection of all main silver contacts, both moving and stationary.

And it's easier to replace main stationary contacts, too, due to the use of individual spring retaining clips.

Write for Bulletin 4110. It fully describes Ward Leonard's new Size 1, 2 and 3 across-the-line, non-reversing AC magnetic starters. Ward Leonard Electric Co., 24 South Street, Mount Vernon, N. Y. Offices in principal cities of U. S. and Canada.

WARD LEONARD ELECTRIC COMPANY
Result-Engineered Controls
RESISTORS • RHEOSTATS • RELAYS • CONTROL DEVICES

MEETINGS & CONVENTIONS

America Society for Testing Materials, 1916 Race St., Philadelphia 3—First Pacific area national meeting Fairmont Hotel, San Francisco, October 10 to 14. Several technical committees will hold sessions and some 70 technical papers will be presented. Subjects to be dealt with include plasticity and fatigue of metals, dynamic stress determinations, high additive content oils, and turbine oils.

Air Conditioning School for Maintenance Men—The Bahnson Co., 1001 S. Marshall St., Winston-Salem, N. C., will again conduct two one-week terms of classes for maintenance engineers on industrial air conditioning. Starting October 10 and 17, courses will duplicate each other. Lectures and inspection trips will cover a wide range of subjects and talks will be given by engineers affiliated with various equipment manufacturers.

American Standards Association, 70 E. 45th St., New York 17—The 31st annual meeting, October 11 to 14, Waldorf-Astoria hotel, New York City. Meetings of various committees, the standards council, and the board of directors are scheduled. Also planned is a company member conference and reports on international developments in standardization. Karl T. Compton, chairman, Massachusetts Institute of Technology, and chairman, research and development board of the National Military Establishment, will speak at the annual luncheon meeting, October 14.

Fourth Annual Short Course on Instrumentation for the Process Industries—October 12 to 14, A. & M. College of Texas, College Station, Tex. The course will be conducted as a seminar with lectures and discussions on automatic control. Anyone living either in or outside of Texas may take the course on payment of a $5.00 registration fee. Rooming accommodations and meals will be available on the campus and additional information may be obtained from Prof. P. G. Murdoch, chemical engineering dept.

American Gas Association, 420 Lexington Ave., New York 17—The 31st annual convention, October 17 to 20, Chicago. Headquarters for the technical section will be the Morrison hotel. For the industrial and commercial gas section, as well as the residential gas section, the Sherman hotel will be headquarters. Applications for hotel accommodations should be sent to the AGA Convention Room Reservation Bureau, Room 808, 105 W. Madison St., Chicago 2.

American Welding Society, 33 W. 39th St., New York 18—The 30th annual meeting, Hotel Cleveland, Cleveland, the week of October 17. As usual, the meeting will be held in conjunction with the National Metal Exposition at the Cleveland Public Auditorium. Three other technical societies, the American Society for Metals, the American Institute of Mining and Metallurgical Engineers (metals division), and the Society for Nondestructive Testing will also convene for their annual meetings at the same time.

The AWS has scheduled a total of 77 papers to be presented at 21 technical sessions.

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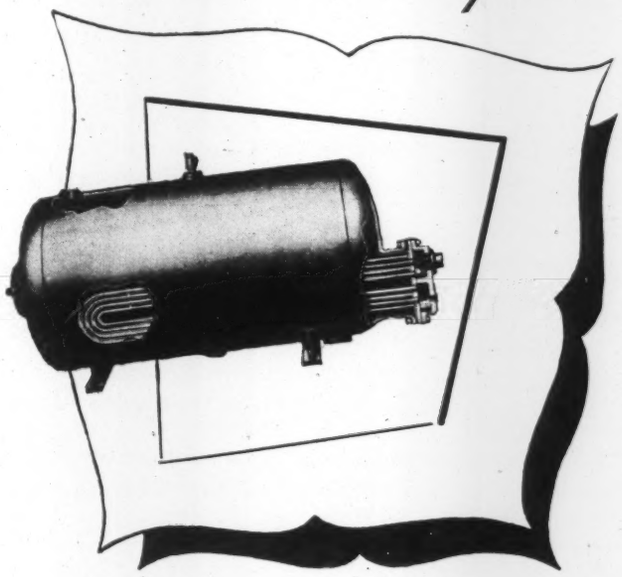

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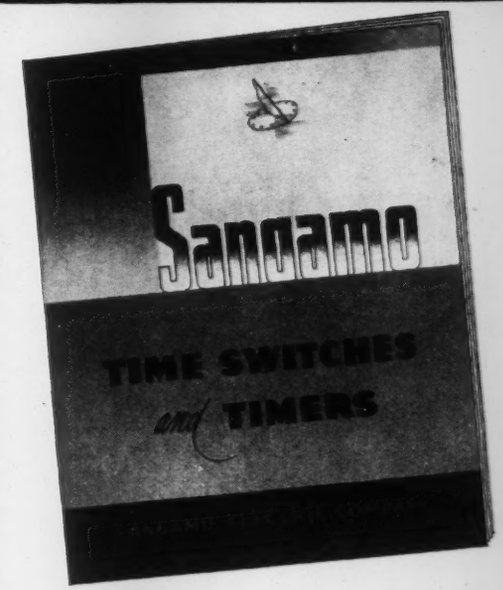

Every time switch user will find practical answers to time control problems in this unusual new 16 page catalog. It contains complete information, specifications, wiring diagrams and prices—everything you need to help you choose the *best* possible switch or timer for your next installation.

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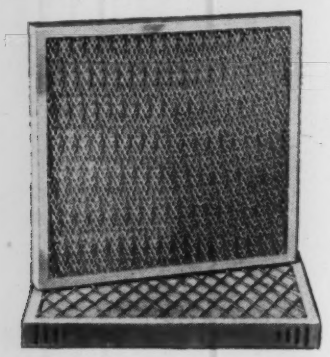

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A permanent, cleanable viscous type filter of all galvanized construction, having full bronze welded corners. Expanded metal face plate acts as lint arrestor to provide easier cleaning and servicing. Rated filtering efficiency 98.5%. In standard 1" and 2" thickness.

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The 37th National Safety Congress and Exposition, October 24 to 28, Chicago. Sessions on industrial safety are scheduled for the Stevens, Congress, and Morrison hotels. Further information can be obtained from R. L. Forney, general secretary, National Safety Council, 20 N. Wacker Dr., Chicago 6.

2d Biennial Pacific Chemical Exposition, November 1 to 5, San Francisco Civic Auditorium—A display of natural resources of the 11 western states is to be a featured exhibit at the show which is sponsored by the California Section, American Chemical Society, Whitcomb hotel, San Francisco 1. Marcus W. Hinson is managing the affair.

During the show, a number of one and two day conferences will be held by various organizations including the American Institute of Chemical Engineers, northern California section, the northern California rubber group, petroleum division, American Chemical Society, California section, and the Society of the Plastics Industry, San Francisco section.

Ninth Midwest Engineering and Power Exposition—November 11 to 16, Navy Pier, Chicago. George E. Pfisterer, 308 W. Washington St., Chicago, is managing director.

Refrigeration & Air Conditioning Contractors Association (formerly National Association of Refrigeration Contractors), 228 N. La Salle St., Chicago 1—The fourth annual convention, Atlantic City, November 13 and 14. These dates have been selected in preference to dates previously set so members may attend sessions and the 6th All-Industry Refrigeration and Air Conditioning Exposition as desired.

Sixth All-Industry Refrigeration and Air Conditioning Exposition, 1346 Connecticut Ave., N.W., Washington 6, D. C.—November 14 to 18, Atlantic City Auditorium, sponsored by the Refrigeration Equipment Manufacturers Association. Over 5000 rooms have been pledged by nearby hotels and approximately 75,000 sq. ft. of exhibition space will be used. Headquarters for cooperating associations are: Traymore hotel, REMA and exhibitors; Claridge hotel, Refrigeration Equipment Wholesalers Association; Ambassador hotel, Refrigeration Service Engineers Society and Refrigeration and Air Conditioning Contractors Association; Chalfonte-Haddon Hall, Air Conditioning and Refrigerating Machinery Association and National Electrical Manufacturers Association.

American Society of Mechanical Engineers, 29 W. 39th St., New York 18—Annual meeting, November 27 to December 2, Hotel Statler, New York City.

The Society's spring meeting is scheduled for April 12 to 14, Hotel Statler, Washington, D. C.

American Society of Refrigerating Engineers, 40 W. 40th St., New York 18—1949 annual meeting, December 5 to 7, Edgewater Beach hotel, Chicago.

National Warm Air Heating and Air Conditioning Association, 145 Public Square, Cleveland 14—The 36th annual convention, December 14 and 15, Hotel Cleveland, Cleveland.

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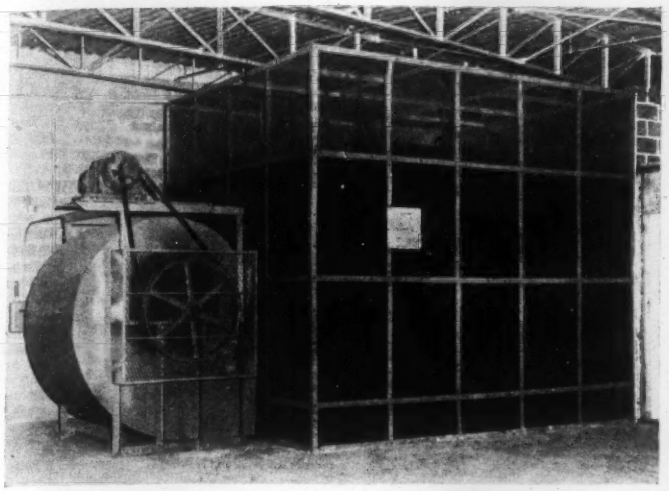
ARE DOING A BETTER HEATING JOB AT LESS COST



200,000 to 5,000,000 BTU in single units.

The Johnson System of Air-Rotation (Pat. Apl'd. For) circulates large volumes of warm air to all parts of an open building without piping or ducts, and heats the building faster than any other method. It keeps the warm air at the "working level", which means comfortable working conditions throughout the plant, regardless of outside weather, and it means warm, dry floors.

Fast heat recovery is assured even when large loading doors are frequently opened and closed.

Johnson Direct-Fired Heaters are fully automatic in operation, using either light or heavy oil, coal with stoker firing, or gas.

The Johnson Heater is revolutionary in design. Multiple banks of criss-cross air heating tubes are placed directly over the fire for maximum heat transfer from the fire to the heated air delivered into the building.

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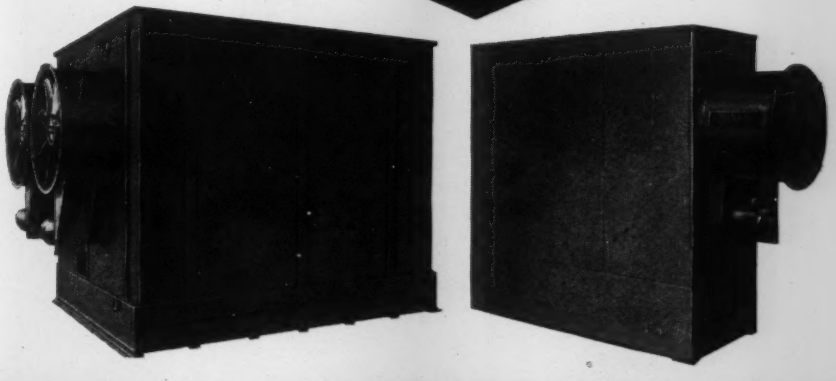
create their own air movement!

Binks Type 2-D Horizontal Induced Draft Cooling Towers are standard where natural air movement is restricted. They create their own draft for efficient operation . . . can be operated indoors or outdoors. Engineered to give many years of trouble-free service, these modern, compact units are available in a wide variety of standard sizes and capacities. Provide maximum cooling at lowest possible cost . . . you can use the same cooling water over and over. Highly efficient for cooling circulating water for refrigeration and air conditioning condensers. Also suited to a wide variety of industrial processes where heat is liberated to circulating water.



Send today for Bulletin No. 33 (describing single fan) or Bulletin No. 34 (describing twin fan) Horizontal Induced Draft Cooling Towers. Contain charts, dimensions and other data to help you choose the right Binks Type 2-D Units. State tower capacity required.

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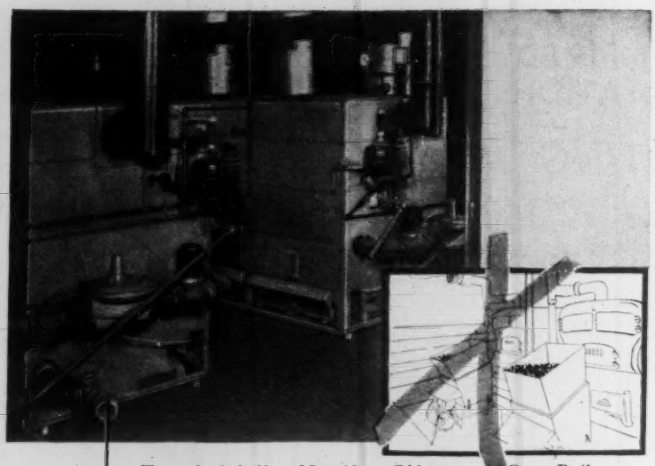
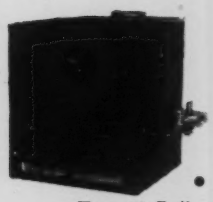


Two fuel-thrifty Mueller Climatrol Gas Boilers (20-S-31) now heat the 160-unit Saybrooke apartments in Pittsburgh. Replacing 3 bulky stoker-fired boilers, they occupy only part of the former coal-bin. This replacement cut fuel-bills, and eliminated the annual $900 maintenance expense plus the monthly $260 labor expense.

Another case where

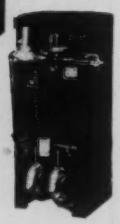
Mueller Climatrol Gas Boilers

made a sale on savings



Type 20 Boiler

Type 10 Boiler



Type 11 Boiler

Sales come easy when you can prove savings — as was the case on the Saybrooke apartments described above.

Mueller Climatrol Gas Boilers are engineered to give you that kind of selling ammunition! You can go out after any hot-water or steam job — from 4 rooms to 400 — and stand a good chance of getting it.

These handsome, compact gas boilers are installed quickly and easily. Operation is quiet and economical. *Customers stay satisfied!*

Push the Mueller Climatrol Gas Boiler — for new installations and for profitable replacement business. Write for full details. L. J. Mueller Furnace Company, 2019 West Oklahoma Avenue, Milwaukee 7, Wisconsin.

MUELLER Climatrol

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Plant Maintenance Exposition and Conference, January 16 to 19, Cleveland Auditorium—Exhibits and conference subjects will deal with air conditioning, heating, ventilating, building supplies, electrical equipment, employee relations, instruments, lubricants, paints, materials handling, power generation and transmission, welding, etc. A 15-man board of leading industrialists and editors is acting as an advisory group. Advance registration cards and hotel information may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, exposition manager.

American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York 10—56th annual meeting, Adolphus and Baker hotels, Dallas, Tex., January 23 to 26. For additional information see the ASHVE Journal Section in this issue.

Southwest Air Conditioning Exposition of the International Heating & Ventilating Exposition—State Fair Grounds, Dallas, Tex., January 23 to 27. As in past years, the show will be managed by International Exposition Co., Grand Central Palace, New York City, and will be held under the auspices of the American Society of Heating and Ventilating Engineers which is represented by an advisory committee headed by A. E. Stacey, Jr., president of ASHVE. The show is expected to fill the Hall of Agriculture and the Poultry Building. For additional information see the ASHVE Journal Section in this issue.

National Association of Corrosion Engineers, 919 Milam Bldg., Houston 2—The 6th annual conference, St. Louis, April 4 to 7. Symposia under consideration include round table discussions on general corrosion problems and corrosion in connection with pipe lines, refrigeration and air conditioning, and the food industry.

Finds Temperature Drop in Aluminum Ducts Relatively Low

The increased use of aluminum in the fabrication of duct work for commercial heating and ventilating has stimulated interest concerning the temperature drop through a bare aluminum heating duct as compared with other types of duct construction. Aladdin Heating Corp., Oakland, Calif., performed comparison tests, under the supervision of Prof. B. F. Raber and J. T. Gier, for Permanente Products Co.

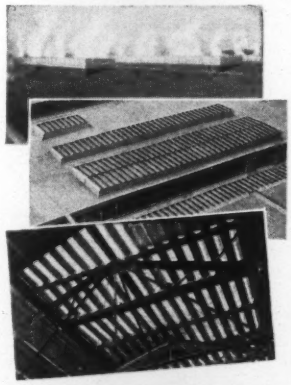
Four 12 in. diameter round ducts were used, approximately 100 ft long, and the temperature drops observed were taken as indications of the effects due to various surface emissivities. Typical temperature drops per 100 ft, as calculated from the experimental data for comparison purposes, are: new aluminum, 43 F; bare galvanized iron, 52 F; galvanized iron duct covered with ¼ in. aircell asbestos, 45 F; galvanized iron duct covered with asbestos paper, 61 F; galvanized iron duct covered with aluminum paint, 50 F; and asbestos paper covered duct wrapped with aluminum foil, 38 F.

The complete report is available on request from Permanente headquarters, Kaiser Bldg., 1924 Broadway, Oakland, Calif.

You can provide "Open Roof" ventilation efficiency with Swartwout *AIRMOVER*

*** without expensive construction**
*** without high installation cost**
*** without power expense**

Still the most revolutionary idea in roof ventilators, AIRMOVER has proved, in six years, to be an invaluable aid to the ventilation of many types of buildings. Only 32" high, its multiple heat valve design offers least possible air travel friction to contaminated air. . . . Construction problems often encountered in applying roof ventilators are simplified. Weight is distributed over a wider roof area. By the same token, air flow has less difficulty in "finding" the roof opening. Used generously over large heat-producing areas, AIRMOVER truly "opens your roofs to the sky." Write for full information.



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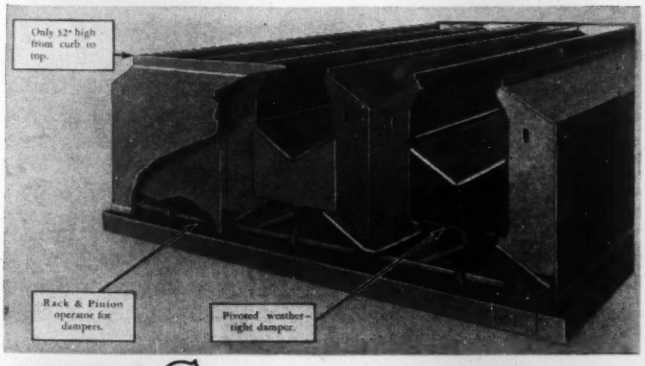


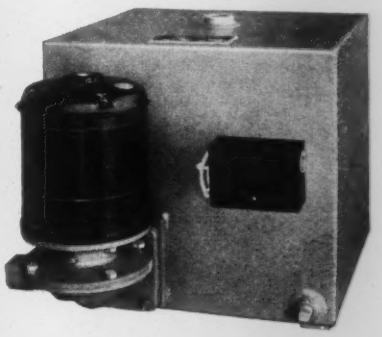
Swartwout *Controlled* **Air Circulation**

A HIT from the start! the Sterlco 4100 SERIES CONDENSATION PUMP

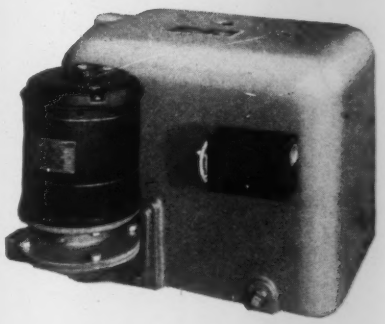
The popularly priced 4100 Series pump, the newest addition to our complete line of condensation pumps, has really "hit the bullseye" with users. Its compactness and neat appearance, its simplicity and sturdiness of construction, its conservative rating for handling emergency overloads, have all contributed to its enthusiastic acceptance.

Before you specify or buy a small condensation pump, be sure to find out about the many quality features of the 4100! The coupon below will bring full information.

The 4100 Series is particularly attractive as a stock unit. Wide range of capacity and pressure ratings in one unit eliminates stocking number of pumps. Requires less than 2¾ sq. ft. of storage space, stacks conveniently.



Sterlco 4100 Series Condensation Pump with steel tank. ¼ H.P. capacity up to 6000 sq. ft. E.D.R. at 20 lbs. Also ½ H.P. unit for 8000 to 14000 sq. ft. at 20 lbs.



New Sterlco 4200 Series unit, for jobs where cast iron tank is preferred. Same ¼ H.P. pump as the 4100—for 6000 sq. ft. maximum capacity. 20 lb. pressure. Also ½ H.P. unit for 8000 to 14,000 sq. ft. at 20 lbs.

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Heat Rays Have No Temperature

Most heat that warms dwellings and working spaces in winter, and makes them uncomfortable in summer, comes from infra red rays; invisible radiations from radiator, furnace, flame, electric device, sun, human beings, animals, wood, plaster ... anything warmer than absolute zero.

Only when that infra red ray is absorbed into a surface is heat actually produced. The surfaces of most objects, including ordinary insulation, absorb more than 90% of the heat rays which strike them. These objects then emit or radiate more than 90% of heat rays from their other surfaces.

That is why Infra Insulation, which absorbs and emits ONLY 3% of radiant heat, is so useful as insulation, confining winter heat where it is wanted, preventing the intrusion of unwelcome summer heat rays.

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Infra's multiple separated aluminum sheets provide 4 reflective spaces and 4 reflective surfaces, each non-condensation-forming. Two sheets of aluminum and the accordion partition block convection currents. Infra's triangular reflective air spaces and small mass eliminate conduction as a problem.

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C.052 Heat Flow Down, equals 6" Rockwool.
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WRITE Infra for more details and FREE COPY of "Bulletin No. 38," issued by the National Housing Agency of the Government, reporting tests of Aluminum Insulation made by the U. S. Bureau of Standards, and dealing principally with the problems of condensation and heat and vapor transfer. ***Address Dept. AC***

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RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on page 151. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

No. 7427: Air Diffusers for Projection Unit Heaters—The type HU diffusers of Anemostat Corp. of America, 10 E. 39th St., New York, are described and illustrated in Bulletin 28. The operation and applications of various models are featured and dimensional data are included.

No. 7428: Air Operated Controllers—Bulletin A120 of Bristol Co., Waterbury, Conn., contains 32 pages and covers the series 500 air operated controllers for temperature, pressure, flow, liquid level, humidity, and pH value. Data are given on on-off, proportional, reset, derivative, and reset plus derivative models.

No. 7429: Aluminum Shade Screening—A 16 page data book on Kaiser aluminum shade screening is available from Permanente Products Co., 1924 Broadway, Oakland 12, Calif. Charts are used to show how the screening blocks solar radiation. Included are data based on transmission temperature tests on shade screening as compared to ordinary insect screening and tabulated data are given for calculating cooling loads.

No. 7430: Arc Welding Accessories—A new 20 page catalog, GEC-253A, contains descriptions, specifications, and prices of more than 150 arc welding accessories of General Electric Co., Schenectady 5, N. Y. Information is included on electrode holders, helmets and goggles, tungsten electrodes, protective aids and clothing, electrode carriers, cable connectors, ground clamps, etc.

No. 7431: Automatic Combustion Controls—Bulletin C-22 of Ace Instrument Co., Inc., 172 Pacific St., Brooklyn 2, covers automatic combustion controls for coal, gas, and oil firing in both stationary and marine applications. Detailed information is given on steam pressure, air flow, and draft regulators.

No. 7432: Baseboard Heating—A new 12 page, non-technical booklet describes the advantages and design and construction features of baseboard heating units offered by C. A. Dunham Co., 400 W. Madison St., Chicago 6. Units are available with either steel pipe and steel fins, copper tubing with copper fins, or copper tubing with aluminum fins.

No. 7433: Bellows Type Expansion Joints—MagniLastic Div., Cook Electric Co., 2700 Southport Ave., Chicago 14, has published a new 20 page manual and catalog (No. 50) on its line of packless, bellows type expansion joints. Dimensional drawings, tables, and related piping data are given in addition to details on applications.

No. 7434: Career of Dr. W. H. Carrier and the Growth of Air Conditioning—An address dealing with the life and work and contributions of Dr. Carrier was delivered dur-

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Industrial Gas Conversion Burners

700 Series Industrial Conversion Gas Burners

For 60,000 to 2,000,000 BTU Requirements

Reinhard Industrial Gas Conversion Burners (700 series) are built to meet specifications requiring 60,000 to 2,000,000 BTU's . . . . for cast iron sectional and steel fire box boilers.

The cast burner heads employ the Up-Shot principle and will withstand tremendous heat. They make maximum use of fuel to give real fuel economy. Exceptionally quiet in operation.

Write for complete information, prices and specifications. No obligation.

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You SHOULD HAVE THIS Dux-Sulation SAMPLE KIT!

NOW — IN HANDY FORM: ACTUAL "SWATCHES" PLUS USEFUL INFORMATION

Yes, you should be familiar with Asbestos Protected Dux-Sulation—the flexible duct insulation with "nine lives"! Not only does this unusual product save fuel, but it deadens metallic noise, offsets overloads, reduces the power load, prevents condensation, prevents rust, absorbs sound, reduces vibration—and besides, it improves the appearance of the duct system.

PERFECT FOR ANY TYPE DUCTS . . . . .

Asbestos Protected Dux-Sulation can be applied to either the inside or the outside of round, rectangular or irregular shaped ducts and fittings. It won't crack, chip, or buckle, and its unique flexible construction makes it a superior insulation for all types of warm air heating, air conditioning and ventilating duct work.

ASBESTOS PROTECTED DUX-SULATION WON'T DETERIORATE . . . . .

It is a rot-proof, mildew-proof, insect-proof duct insulation that is durable and cuts down maintenance costs. Because of its comparatively light-weight, interwoven Asbestos membrane and smooth moisture-resistant finish, it does not tend to pull away from the duct surfaces.

IT'S SAFE AND EASY TO APPLY . . . . .

You can cut down labor costs by specifying Asbestos Protected Dux-Sulation on all your jobs. No screws, wires, lugs or bolts are needed. Every roll of ½" and 1" thick comes complete with a special adhesive and asbestos protected tape for covering the corners and joints. Asbestos Protected Dux-Sulation comes in convenient to handle and stock rolls, 36" wide, containing 100 square feet.

Check with your jobbers today about prices of Dux-Sulation.

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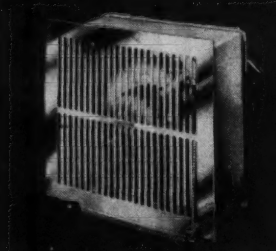
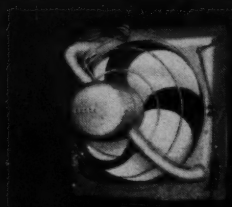
For installation in *any* outside wall. Either fully automatic or "pull-chain" operation. Easily installed. 8″, 10″ and 12″ sizes.





Package Type

For window pane or thin wall installation. "Pull-chain" operation. Large capacity . . . smooth running . . . super-quiet. 8″ and 10″ sizes.

Panel Type

For quick, easy installation in window frame. Requires just four screws and a few minutes work. 8″, 10″ and 12″ sizes.

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ing the 1949 Syracuse dinner of the Newcomen Society of England by Cloud Wampler, member of the society and president, Carrier Corp. A limited number of copies of the address, in the form of a 32 page booklet, are available from Carrier Corp., 300 S. Geddes St., Syracuse, N. Y.

No. 7435: Cathodic Protection Against Corrosion—This is the title of the feature article in the Vol. 18 No. 6 issue of the house organ published by W. H. & L. D. Betz, Gillingham & Worth Sts., Philadelphia 24. The fundamentals of this method of protection for steel surfaces submerged in water are covered and developments to date are briefly reviewed.

No. 7436: Chlorine Feeders and Meters—The "Chlorinizer" of Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence 1, R. I., is designed to accurately meter and feed chlorine gas. Volumetric models CVS and DVS are used to meter the gas and to produce a chlorine-water solution to the point of application. They are described in Bulletins 840-F1 and 840-F2 respectively. The gravimetric model CGS meters and feeds gaseous chlorine by the loss-in-weight principle and is covered in Bulletin 840-F3T.

No. 7437: Coated and Bonderized Sheet Steel—Recommended methods for forming, joining, and painting "Zincgrip-Paintgrip", a special zinc coated and bonderized sheet steel, are given in a 12 page bulletin issued by Armco Steel Corp., 1049 Curtis St., Middletown, Ohio. Helpful suggestions for shop men are given in sections on storage, forming, and drawing; welding and soldering; and cleaning and painting.

No. 7438: Combustion Safeguard for Gas Fired Equipment—Bulletin W1816 of Bristol Co., Waterbury 91, Conn., describes the new electronic "Pyrotrol" combustion safeguard for protecting gas fired ovens, kilns, furnaces, boilers, dryers, kettles, and other industrial equipment from the danger of explosions during ignition, operation, and shutoff.

No. 7439: Condensate Drainage—A new 24 page booklet (No. 3250) on the C-B system of condensate drainage control has been released by Cochrane Corp., 17th St. & Allegheny Ave., Philadelphia 32. Included are six pages of discussion describing this high pressure, high temperature condensate return system followed by specifications on two types of units, after which are detailed 57 case histories.

No. 7440: Control of Preventive Maintenance—The "Kardex" visible maintenance control system is a record control system for effectively administering a program of preventive maintenance of machines and equipment. It is described in a six page folder, KD-449, issued by the systems and methods research department, Remington Rand, Inc., 315 Fourth Ave., New York 10. The folder also outlines how preventive maintenance records may be combined with property records to insure that the right amount of equipment is on hand at all times and is in top operating condition. A section is also devoted to inventory systems used to control stocks of replacement parts and operating supplies.

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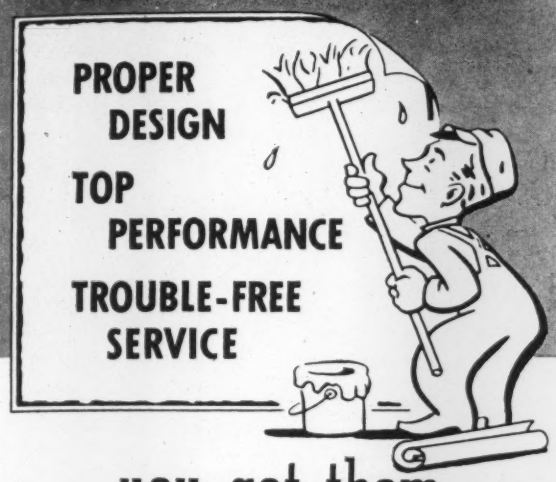
What you should expect from a pump



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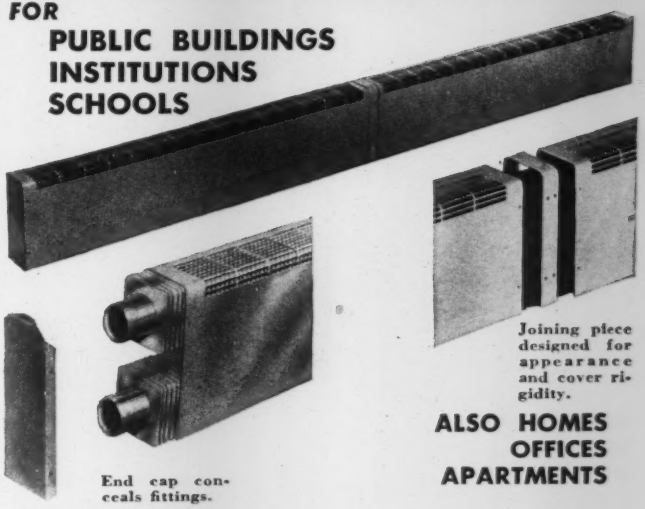

End cap conceals fittings.

Joining piece designed for appearance and cover rigidity.

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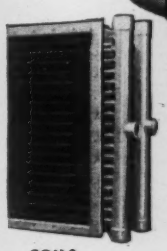

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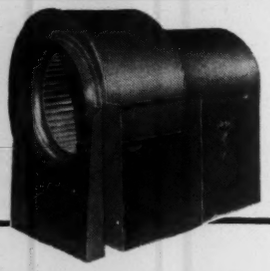

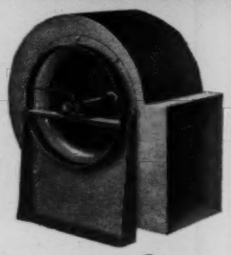

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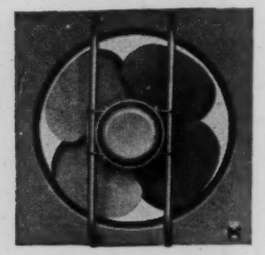
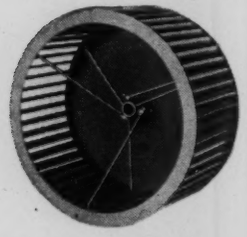
SIZES 12" to 48"



Peerless Electric
Type PVS Deluxe Fan



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Belt drive units are powered with ½ to 7½ h.p. motors; direct drive units ½ to 2 h.p. motors. All units supplied with or without weatherproof hood covers for drive mechanism.

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No. 7441: Convector Radiators—Data on the construction, installation, and operation of "National Art" convectors in stores, offices, schools, institutions, homes, etc., are contained in Catalog 555 of National Radiator Co., Johnstown, Pa. Dimensions, roughing-in charts, ratings, and other pertinent information are included.

No. 7442: Copper and Brass Sheet, Tube, Rod, etc.—Information on size ranges, tempers, hardness, tensile strength, machineability, and ASTM specifications is given on copper and brass sheet, tube, bar, rod, wire, and pipe in a data sheet prepared by Central Steel & Wire Co., P. O. Box 5310-A, Chicago 80. The tabulated data sheet is said to be a condensation of almost 40 pages from the firm's stock list.

No. 7443: Corrosion Resistance of Castings—Cooper Alloy Foundry Co., Hillside 5, N. J., has published a new bulletin giving information on the corrosion resistance of its stainless, monel, and nickel castings. Prepared by N. S. Mott, chief chemist and metallurgist for the company, the bulletin lists castings by American Castings Institute designations as well as those of the company and provides tabulated data on resistance to acids, organic materials, wet and dry salts, gases, alkalis, etc.

No. 7444: Distant Reading Thermometers—"Alnor" distant reading electric thermometers are described and illustrated in Bulletin 2451-C of Illinois Testing Laboratories, Inc., 420 N. La Salle St., Chicago 10. The temperature range is from —100 F to 400 F at distances up to

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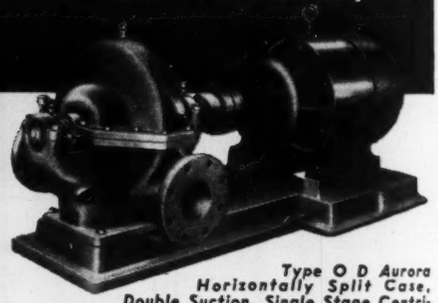
This Truly Great AURORA TYPE O D CENTRIFUGAL PUMP

for general water supply, for municipalities, industrial establishments.
also for handling condenser circulating water, wash water, liquids in paper mills and distilleries, chemical solutions, oils in oil fields and refineries, irrigation, etc.



Type O D Aurora Horizontally Split Case, Double Suction, Single Stage Centrifugal Pump.

The ultimate in design and perfection—type O D pumps—in capacities to 4,000 G.P.M. and heads to 300 ft.—are accessible, compact and lasting. The horizontally split-case type of design permits removal of upper half of casing without disturbing suction or discharge. The impellers and water channels are streamline designed to minimize flow resistance and avoid turbulence, cavitation and consequent corrosion and erosion.

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APCO TURBINE-TYPE PUMPS
For high pressure, Small capacity requirements (up to 150 G.P.M.). Wide operating range characteristics. No metal to metal contacts. Handles non-lubricating liquids without wear. Only one moving part—the Impeller.

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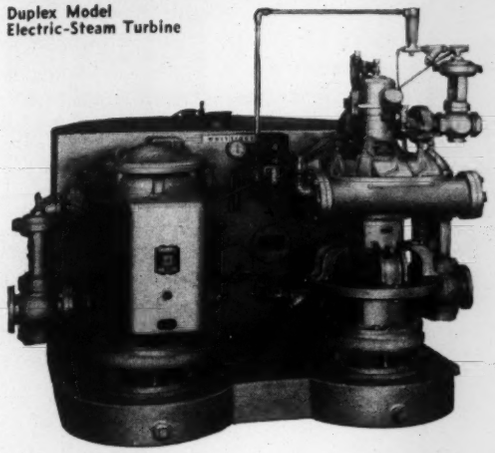
Duplex Model
Electric-Steam Turbine



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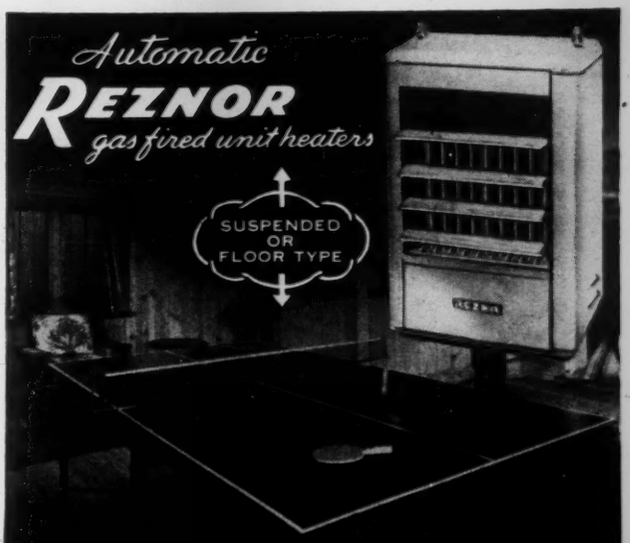

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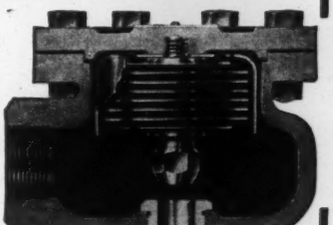
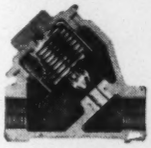
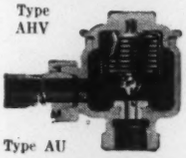


Type C



Type AHV



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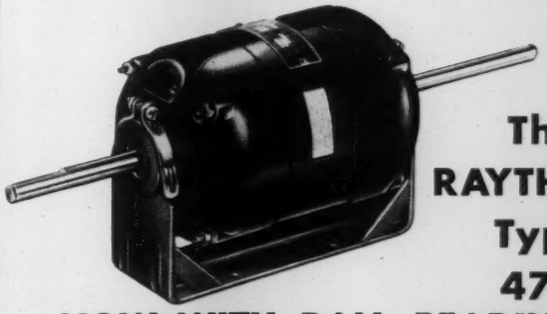

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1000 ft. The booklet gives detailed information on sizes, types, applications, prices, and installation and operation instructions.

No. 7445: Flexible Metal Hose—Catalog 100 of Atlantic Metal Hose Co., 123 W. 64th St., New York 23, covers new uses for existing types of the firm's flexible metal hose and developments of new type hose. Featured are interlocking hose and seamless hose as a flexible medium for such applications as diesel exhausts; conveying liquids, solids, and semi-solids; and in heat and pressure problems. Test tables, installation methods, and applications are included.

No. 7446: Fractional Horsepower Motors—Designed for oil burner, blower, circulator, pump, jet, turbine, and other applications, units are described and illustrated in a new catalog of Franklin Electric Co., Inc., Bluffton, Ind.

No. 7447: Hydraulic Oils—E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, has published a revised edition of its handbook on hydraulic oils. A new chapter covers recommended procedures for flushing hydraulic systems which have become contaminated. Other chapters deal with specifications, additive treatment, and trouble shooting.

No 7448: Industrial Oil and Oil-Gas Burners—Bulletin No. 50 of the burner division, Enterprise Engine & Foundry Co., 608 Florida St., San Francisco 10, includes

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says Frank M. Kriwanek, General Manager, La Brea Heating and Air Conditioning Co., Los Angeles, Calif.

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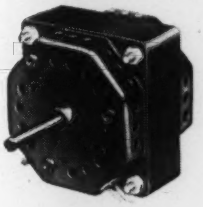
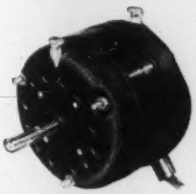
Alliance builds 4-pole and 6-pole shaded pole induction motors with speeds from 500 to 1550 rpm and from 1/100 h.p. up to 1/25th h.p. Smaller 2-pole shaded pole motors will supply as little as 1/400 h.p.

MODEL B
4-pole shaded pole motor. Approx. 1/30 h.p. 1550 r.p.m.





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6-pole shaded pole motor. Approx. 1/30 h.p. 500 to 1050 r.p.m.

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2-pole shaded pole motor — full load h.p. .0021. Full load 2800 r.p.m.

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- Room Heaters
- Exhaust Fans
- Coolers
- Air Conditioners
- Unit Heaters
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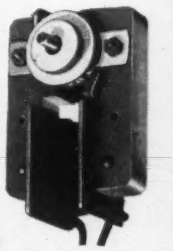
- Controls



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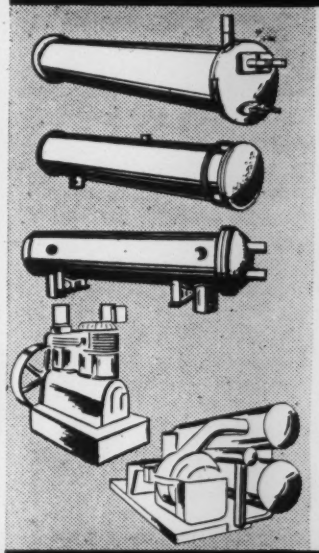

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Manufacturers of Automatic Pressure, Temperature, Level & Flow Controls

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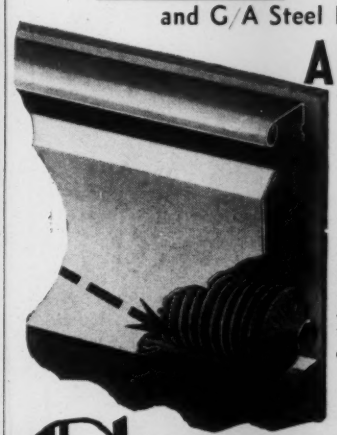

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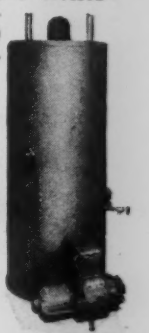

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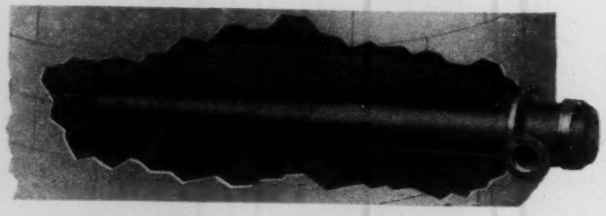
This popular heater is low in cost, simple in design. Made with straight tube bundle having a rolled steel tube sheet welded to shell, minimizing the number of joints. Type V-1 is designed for easy mechanical cleaning without breaking any line connections. Four standard sizes cover most industrial requirements.

Type W Heater for High Temperatures

To compensate for differential expansion or contraction between shell and tubes, Type W incorporates a special Whitlock fabricated expansion member. Straight tubes allow easy mechanical cleaning. Standard sizes are designed for working pressures of 250 p.s.i. or 400 p.s.i. on both shell and tube side, but can be supplied for elevated oil and steam pressures when required.



Suction Type Fuel Oil Heater

These heaters facilitate pumping from large storage tanks by heating oil for easy removal. Since oil is heated only as it is drawn off it is not necessary to heat entire contents of tank. Heating section is of U-bend type steel tubing. Unit can be readily welded, riveted or bolted to storage tank as required.

Write for Bulletin 35

The Whitlock Manufacturing Co.

44 South St., Elmwood, Hartford 2, Conn.

New York • Boston • Chicago
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WHITLOCK HEAT TRANSFER EQUIPMENT

photographs, charts, and wiring and piping diagrams on automatic industrial, horizontal rotary oil and combination oil-gas v belt burners. Also shown are typical applications such as boilers, kilns, dryers, furnaces, etc.

No. 7449: Laboratory and Plant Instruments—Etched stem glass thermometers for various temperature ranges from —120 to 1160 F, numerous special and industrial thermometers for permanent or intermittent batch use, psychrometers, thermo-regulators, mercury plunger relays, and hydrometers are some of the instruments described and illustrated in a 40 page catalog (No. 15) released by H-B Instrument Co., 2633 Trenton Ave., Philadelphia 25.

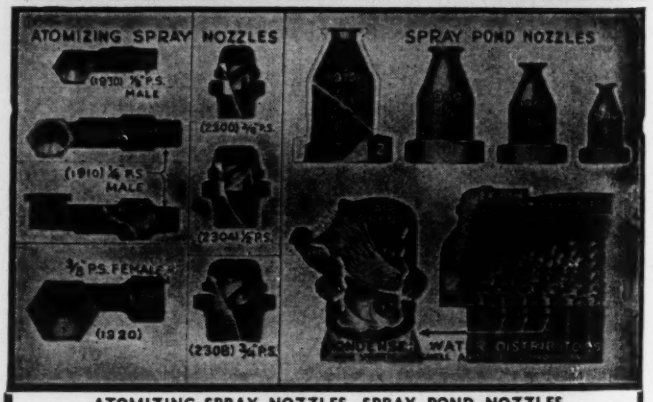
No. 7450: Machines and Tools for Sheet Metal Work—Folders and brakes, hand and power rotary machines, beaders, crimpers, groovers, slip roll formers, squaring shears, presses, and bench tools are some of the products briefly described and illustrated in Booklet 200-G of Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11.

No. 7451: Mercury Tube Switches—Advantages, design and construction features, applications, and specifications of mercury switches are contained in Catalog 1343 of Brown Instruments Div., Minneapolis-Honeywell Regulator Co., Philadelphia 44.

No. 7452: Packaged Air Conditioners—Designed for a wide variety of applications, units are described in a series of bulletins issued by the air conditioning dept.,

QUALITY always wins!

MARTOCELLO Products are fully DEPENDABLE



ATOMIZING SPRAY NOZZLES, SPRAY POND NOZZLES, AND CONDENSER WATER DISTRIBUTORS

For Vertical Shell and Tube Ammonia Condensers

ALL MARTOCELLO SPRAY NOZZLES are manufactured with precision and of a design which has been thoroughly tested for maximum results and durability. They are guaranteed to give satisfaction. Successful, efficient results depend largely upon selecting the proper number, type and size of Nozzles suitable for your installation.

THE MARTOCELLO CONDENSER WATER DISTRIBUTORS are now used as standard equipment by Progressive Refrigerating Engineers in solving their manpower problem, because they require no attention and assure users of the lowest Condenser Operating Pressures and Minimum Power Cost. It will pay you to consult us. WRITE or WIRE for further information.

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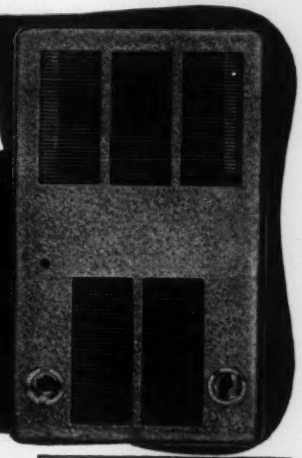

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Electric
BUILT-IN
AIR HEATERS

Here is electric heating at its modern best, suitable for offices, public buildings, restaurants and homes. Attractively styled CHROMALOX Built-in Air Heaters are easily installed, built to give years of trouble-free comfort heating and fit between standard 16" studding. Thermostatic controls make it easy to maintain the required warmth. Heater can be operated at full or partial capacity with forced air circulation; or fan used alone circulates unheated air.

NO OTHER HEATER OFFERS ALL THESE FEATURES

- Enclosed Chromalox Heating Elements sheathed in Inconel
- Individually selected temperatures
- No fumes to discolor walls, woodwork
- No heater-generated dust or dirt
- No expensive replacement
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Write for free booklet No. F-1514 which shows how to select and install the right heater for any room.

EDWIN L. WIEGAND CO., 7610 THOMAS BOULEVARD, PITTSBURGH 8, PA.

CHROMALOX 89-14

ELECTRIC HEATING AT ITS BEST!

Pump Talk

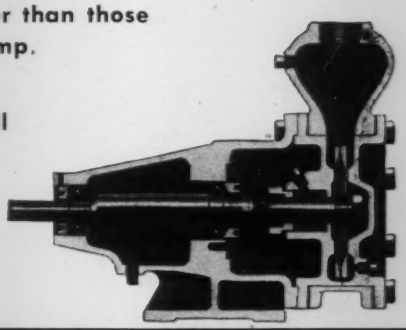
Roth Pumps last longer because of extra heavy stainless steel shafts.

We invite your comparison of the diameter of our shafts with those on any other similar pump.

Extra heavy shafts make practical the Roth cantilever construction with all of its obvious advantages . . . Separable liquid end, easily replaced side plates and impeller, easily indexed liquid end.
Only one stuffing box.

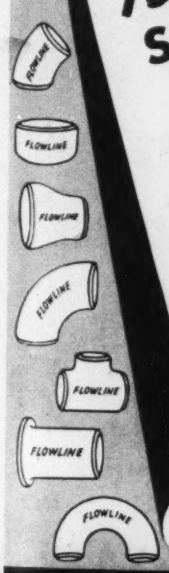
The shafts in Roth Turbine Type Pumps are heavier than those in any similar pump.

Write for catalog section 101 for full data on Roth Turbine Type Pumps.



ROY E. ROTH COMPANY
2484 Fourth Avenue Rock Island, Illinois

1965 STAINLESS STOCK ITEMS
in FLOWLINE TRADE MARK
Stainless Steel Welding Fittings



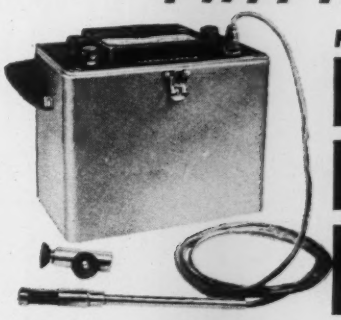
The most complete line ever offered—available in three Stainless Types (304, 316, 347) to match pipe and tubing of various wall thicknesses in sizes from ¼" through 12"; in all standard fittings illustrated. Special fittings, and other analyses, can be supplied on special order.

All *FLOWLINE* fittings are made of *forged* or *rolled* stock; annealed, cleaned, and passivated for maximum corrosion resistance. Their use makes possible fabrication of every type of stainless piping system with minimum equipment simply by straight cutting of tubes to desired lengths, and plain butt welding.

The most complete line of Stainless Steel Welding Fittings
Send for Bulletin S-310

WELDING FITTINGS CORP.
NEW CASTLE, PENNSYLVANIA
Formerly Stainless Alloy Division, Pittsburgh Piping and Equipment Co.
World's Largest Manufacturer of Stainless Steel Welding Fittings

ANEMOTHERM AIR METER



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FROM 30F to 155F

STATIC PRESSURE
FROM 0 TO 4 NEG. AND FROM 0 TO 10 POS. IN. WG

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CONVECTOR-RADIATOR ON THE MARKET

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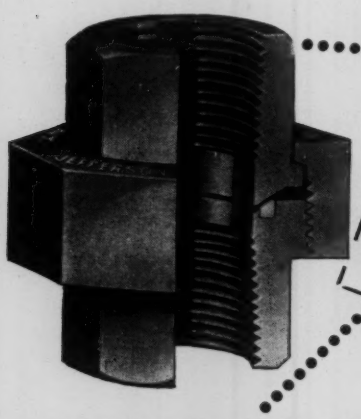
NEW YOUNG LINE OFFERS 8 IMPORTANT FEATURES

1. OVER-SIZE GRILLE gives greater heat delivery; louvers direct air outward.
2. EASY-TO-CLEAN CABINETS feature easy-to-remove front panels.
3. SIMPLIFIED PIPING possible with top and bottom header connections and generous cabinet knock-outs.
4. SENSITIVE HEATING ELEMENT, of efficient, non-ferrous, tube-and-fin design, means quicker response to controls.
5. IMPROVED HEATING ELEMENT SUPPORTS permit quick installations and pitching adjustments.
6. MODERN CABINETS may be painted any color; corners are rounded, edges flanged for safety.
7. AIR-SEAL prevents air leaks and wall streaking.
8. DAMPER CONTROL regulates heat flow; permits individual room temperature control.

Be sure to send for complete information on the new Young Line of Convector-Radiators; No obligation.

YOUNG RADIATOR CO. Dept. 519-K, Racine, Wis. Plants at Racine, Wis., and Mattoon, Ill.
Sales and Engineering Offices in All Principal Cities



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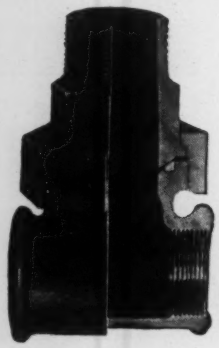
Close fits are simple with Jefferson Unions . . . and once in they'll STAY in because we make them from a very fine malleable iron with a tensile strength of 55,000 lbs per sq in. Details such as the machining instead of casting the ring channels . . . making the rings from special tubing instead of casting them and testing all fittings with air before delivery all add up to a minimum of maintenance after the installation. You're sure the job's in to stay when the joints are made with Jefferson Specialty Unions.



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607 West 26th Street, New York 1, N. Y.
35 Fletcher Avenue, Lexington 73, Mass.
65 Gooding Street, Lockport, N. Y.

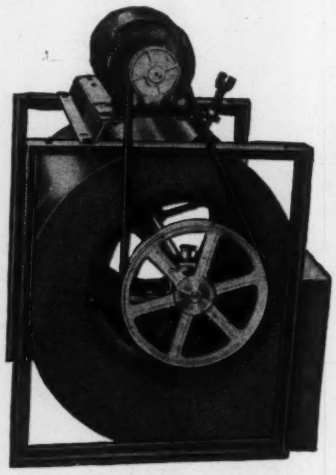
General Electric Co., Bloomfield, N. J. Each of the bulletins describes and illustrates various features and gives specifications, ratings and dimensions. Bulletins PM 79-0101, PM 79-0201, PM 79-0301, and PM 79-0401 cover respectively 2, 3, 5, and 7½ and 10 ton units.

No. 7453: Pressure Regulators for Welding, Cutting—Air Reduction Sales Co., 60 E. 42nd St., New York 17, has issued a 32 page catalog covering its complete line of pressure regulators for welding, cutting, special flame processes, and other operations where controlled gas pressure is required. Some 26 regulators are illustrated and over 100 are described. A section covers adaptors and pressure gages.

No. 7454: Protective Coatings—A new four page bulletin on "Ucilon" protective coatings gives information on four groups of coatings expressly developed for corrosion control, chemical resistance, and "heavy duty" industrial painting. Essential data on various formulations are briefly outlined and case histories are cited. The manufacturer is United Chromium, Inc., 51 E. 42nd St., New York 17.

No. 7455: Radiation—Convector Type—Catalog No. 4049 of Young Radiator Co., Racine, Wis., gives complete information on the company's new line of convector-radiators. Data include construction details, roughing-in dimensions, and ratings for all models.

No. 7456: Refractory Insulation for Boiler Seams—A new folder issued by National Boiler Protector Co., 928



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MASSACHUSETTS . .

By changing the position of the oil cup, the four popular discharges (lower horizontal, upper horizontal, down-blast and up-blast) can be obtained. Sizes 7 to 16½ inches wheel diameter.

WRITE FOR BULLETIN No. 110 CATALOG

MASSACHUSETTS BLOWER DIVISION
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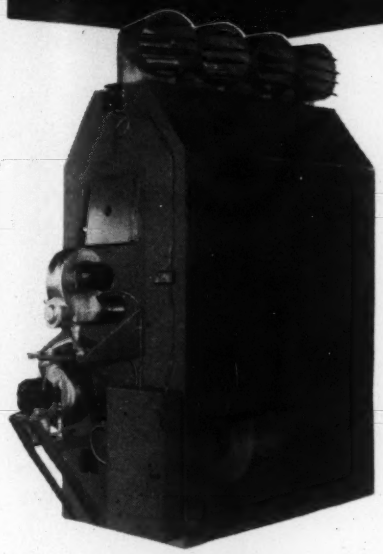
THE COMPLETELY AUTOMATIC DIRECT FIRED HEATER



Olson Units combine Efficiency, Economy and Ease of Maintenance

Olson offers a compact unit designed to deliver up to 85% efficiency. Low in first cost and economical in fuel consumption, the Olson is also the most easily serviced heater in use. All vital parts are accessible without dismantling the unit.

The Olson heater is designed to heat adequately any size building. Capacities range from 300,000 to 6,000,000 BTU. Unit may be operated on gas, oil, or coal. Write for our catalog BE-848.

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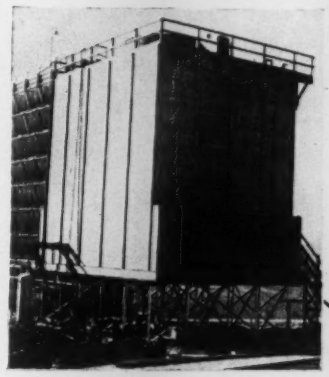

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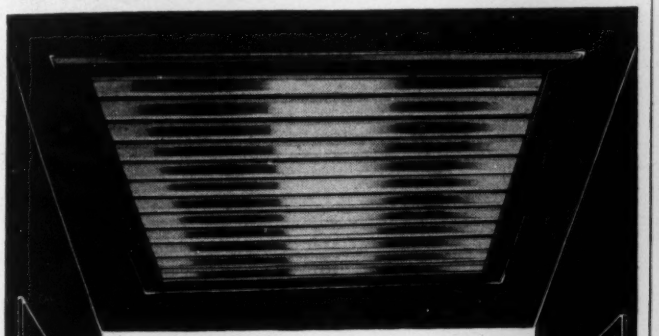

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AUTOMATIC

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FOR ATTIC FAN

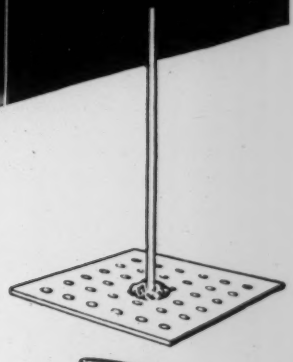
Built so they can be installed practically flush with the ceiling, AIR-FLO Ceiling Shutters present a refined, finished appearance. Their natural aluminum color blends with any decoration, eliminating need for painting, and no grille or winter cover is required. Furnished in 5 different widths, single panel up to 72" long. No operating mechanism shown. Built-in fusible link. Meets fire underwriters requirements.

WRITE FOR NEW CATALOG 43-D

Illustrations and details of the complete AIR-FLO line.

AIR CONDITIONING PRODUCTS CO.
2340 W. LAFAYETTE BLVD. · DETROIT 16, MICH.

Miracle
SURFACE ANCHORS *and* ADHESIVES



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The many users of MIRACLE surface anchors manufactured by DEVICES INC., 280 Madison Ave., New York 16, N. Y., are doing just that by the use of MIRACLE adhesive to bond their units to masonry and other rigid surfaces.

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of AMAZING Impactool Savings

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Impactool jumped production from 60 units a day to 150 units and the $197 tool paid for itself in 11 days.

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The Impactool with special tube rolling attachment cut the time from 80 man hours to 16 man hours. The $165 tool paid for itself in 13.8 hours' use.

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Size 4U — ⅜" bolt dia.
Size 8U — ⅝" bolt dia.
443-18

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ORIGINATOR OF IMPACTOOLS—air and electric

Ribold Bldg., Dayton 2, Ohio, describes its seam protector which is installed to insulate riveted seams of horizontal return tubular boilers. An arch of refractory tile is used to protect the seam from fire-cracking and leaking.

No. 7457: Refrigeration Compressor-Condenser—Specifications of "Eclipse" low pressure refrigerating units, having two, three, four, or six cylinders, are given in Bulletin 791-A of Frick Co., Waynesboro, Pa. For use with "Freon-12", these units have condenser-receivers designed for use with city or cooling tower water. The low pressure range is from 20 in. to 50 psi with an adjustable differential and the high pressure cutout is set at 165 psi. Average capacities, when used on air conditioning work, are from 18 to 55 tons.

No. 7458: Registers, Grilles, and Scoops—Catalog 50 of Stewart Mfg. Co., Inc., 610 Bloomfield Ave., Bloomfield, N. J., gives data, including design and construction features, prices, and dimensions, on the company's complete line. Included is a section on grille cores designed especially for use in convector cabinets and metal or wood cabinets requiring a grille for ventilation or sound. A four page section is devoted to outlet sizing, etc.

No. 7459: Rubber Lined and Hard Rubber Equipment—Five resins for patching, relining, resurfacing, and repair work on rubber equipment are covered in Bulletin C-3 of Carboline Co., 7603 Forsythe Blvd., St. Louis 5. Chief advantages of the resins are said to be resistance to high temperatures, acids, and alkalis, setting or solidification at room temperature, and superior corrosion resistance.

HAYS AIR FILTER GAGE

Watchdog over **YOUR AIR FILTER**

It pays to stand watch over air filters, to guard against possible inefficiency due to excessive dirt collection. Install a Hays Air Filter Gage—It's quick and simple to install . . . indicates air resistance at all times . . . warns when filter element needs cleaning or renewal . . . eliminates guesswork . . . sounds an alarm (if desired) when dirt dams proper air circulation. Full information in Hays Bulletin 46-751. Write for it today!

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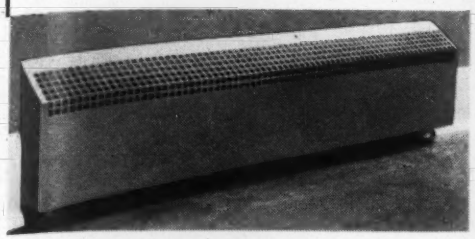

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FOR STEAM OR HOT WATER

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Rempe method of manufacture gives greater BTU capacity per lineal foot. EDR capacity 4.75 per lineal foot of casing length.

Write for prices and discounts.

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Pipe and Fin Coils for Refrigeration and Air Conditioning.

The BEST CONTROL BUY *for* INTERMITTENT OIL BURNERS

MERCOID

AUTOMATIC CONTROLS INSURE FINE PERFORMANCE AND LONG LIFE

TYPE JMI MERCOID SAFETY AND IGNITION CONTROL

"A"—Special high temperature bimetal assures constant sensitivity and long life.

"B"—The differential adjustments permit adjusting in the field to meet variations and fluctuations in stack temperatures.

"C"—Only three mercury switches used for motor, safety and ignition.

"D"—The safety timing mechanism determines the time the burner can operate without flame. It is set at the factory, but may be changed when necessary. In case of a safety shut-down, turn hand reset button to resume operation.

"E"—The Mercoid Transformer-Relay eliminates all noise and residual magnetism. It acts as its own transformer, inducing low voltage current for the thermostat circuit.

"F"—All terminals are plainly marked for correct wiring.

Write for Mercoid Catalog No. 600A

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for fast, dependable bends

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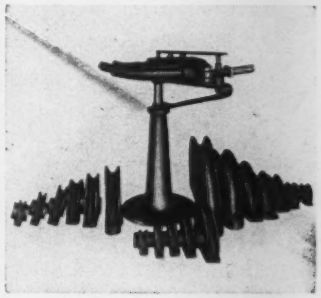

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Bends ½" to 2" standard pipe sizes to a radius of 5 to 1, up to 180°. Special radii within these sizes supplied on request. Usual radiant heat bends for 1¼" at 6" & 9" radii can be supplied. Special radius supplied on request.

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- Versatile—bends cold pipe, conduit and tube, copper and brass I.P.S. without crimping.
- 12,000 in use all over the world.

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Clark DUO-STEP Leverage

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INCREASES TRAP DRAINAGE CAPACITY OVER 100%

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